MINERALS YEARBOOK

Volume III

AREA REPORTS: INTERNATIONAL 1995

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MINERAL INDUSTRIES OF ASIA AND THE PACIFIC

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERALS YEARBOOK

AREA REPORTS: INTERNATIONAL 1995

MINERAL INDUSTRIES OF ASIA AND THE PACIFIC

Volume III

MARCH 3, 1849

UNITED STATES DEPARTMENT OF THE INTERIOR

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UNITED STATES DEPARTMENT OF THE INTERIOR • Bruce Babbitt, Secretary

GEOLOGICAL SURVEY

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people by encouraging care. The Department also has a major responsibility for Native American reservation communities and for people who live in Island Territories under U.S. administration.

Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industry during 1995, and it provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial minerals industries in the United States are also included.

Volume II, Area Reports: Domestic, contains a chapter on the minerals industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has a chapter on survey methods and summary statistics for domestic nonfuel minerals.

Volume III, Area Reports: International, is published in four separate reports. These reports collectively contain the latest available mineral data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and utilization of minerals in each country of the region and how they relate to U.S. industry. Most chapters include production and industry structure tables, information about Government policies and programs affecting the country's minerals industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Gordon P. Eaton
Director

Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed by the Internet at http://www.usgs.gov/. Geologic information on topics such as earthquakes, volcanoes, energy, and mineral resources is available by contacting the Geologic Inquiries Group at (703) 648-4383. Map, digital data, and aerial photography products and information are available by contacting the Earth Science Information Center at 1-800-USA-MAPS. Water data and information may be obtained by contacting the Water Information Center at 1-800-426-9000. For specific information about this publication, contact the Chief, International Minerals Section, Minerals Information Team, at (703) 648-7732 or e-mail at eshekar@usgs.gov or the Chief, Publication Services Section, Minerals Information Team (703) 648-4750 or e-mail at kharris@usgs.gov. General information about the Minerals Information Team may be accessed by the Internet at http://minerals.er.usgs.gov/minerals/.

Acknowledgments

The Country Specialists in the Minerals Information Team, U.S. Geological Survey, in preparing the International Review regional books of Volume III of the Minerals Yearbook, extensively utilized statistics and data on mineral production, consumption, and trade provided by various foreign government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations is gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, from United Nations publications, and from the domestic and foreign technical and trade press. Of particular assistance were the routine and special reports submitted by the 10 Regional Resource Officers assigned to minerals and petroleum reporting and by economic and commercial officers and other officials of the Department of State in U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support was provided by the staff of the Data Collection and Coordination Section.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

John H. DeYoung, Jr.
Acting Chief Scientist, Minerals Information Team

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THE MINERAL INDUSTRY OF

ASIA AND THE PACIFIC

By Chin S. Kuo, Travis Q. Lyday, Pui-Kwan Tse, and John C. Wu

The countries of the Asia and Pacific region possess a large mineral-resource base and are significant suppliers of a variety of minerals to both regional and world markets. Both the developing and the industrialized countries of the region recognize that mineral resource development is an important area of their future economic prosperity. Some more notable developing nations in the region were China, India, Indonesia, Papua New Guinea, the Philippines, and Vietnam. The industrial "tigers" of Asia–Hong Kong, Japan, the Republic of Korea, Singapore, and Taiwan–have few domestic mineral resources. Led by Japan, the economies of each are dependent on imported raw materials; important in regional and international commerce; and advanced, both economically and technologically. Except for Japan, which suffered a catastrophic earthquake early in 1995, mineral development progressed normally during the year throughout the region. Australia, China, and India dominated the commercial mineral exploitation of the region, with Indonesia becoming increasingly active in coal and gold extraction.

According to a survey by Metals Economics Group, the budgets of 154 companies for exploration programs worldwide totaled $2.69 billion in 1995. Funding allocated for exploration in Asia and the Pacific amounted to $785.9 million, or 29% of the total expenditure. The region tied with Latin America for first place in exploration budget allocation. Spending allocated in Australia alone increased by $97.4 million, or 23% of that apportioned in 1994. Exploration spending elsewhere in the Asia and Pacific region also increased, by 52.9%, from the $168.4 million in 1994. The region increasingly became an important exploration target because of its abundance in mineral resources.

Australia continued to be a major player in the international minerals marketplace. It has known reserves of major minerals, which were adequate for both domestic demand and for marketing overseas. It ranked among the world's leading producers of alumina, bauxite, bismuth, copper, diamond, gold, iron ore, lead, lithium, manganese, mineral sands (titaniferous minerals and zircon), monazite (rare earths), nickel, salt, silver, tantalite (tantalum), tin, uranium, and zinc. Mineral exploration expenditures for the fiscal year ending June 30, 1995, far exceeded those of the previous year; and, as a result, identified mineral resources increased.

China was the world leader in proven reserves of antimony, barite, ilmenite (titanium), magnesite (magnesium), molybdenum, rare earths, and tungsten. China also had large resources of low-grade iron ore and important resources of other mineral commodities, such as coal, based on its production and export capabilities.

The Chinese Government reduced its export tax rebates to exporters from 17% to 9%. Originally, exporters could receive rebates of the 17% value-added tax that they had paid on their products for export, but alleged cheating on the rebates caused the Government to make claims of lost revenue. However, rebates remained unchanged for contracts signed for the export of large turnkey equipment valued at more than $10 million and electronic products valued at more than $1 million. The Government amended its rules governing royalties for Sino-foreign onshore oil and gas joint ventures. The amendments provided royalty exemptions for oilfields in Qinghai, Xinjiang, and Xizang, where annual production was less than 1 million metric tons of oil and 2 billion cubic meters of gas. Royalties for Sino-foreign oilfields and gasfields were reduced by 5% in other Provinces and autonomous regions of China.

The Government of India revised its national minerals policy, providing good news for local and international investors. Joint ventures were promoted, allowable foreign equity capital in joint mining ventures was increased to 50%, and restrictions were removed on 13 minerals once reserved for the public sector. The Government was considering proposals to increase the size of exploration concessions available to foreign companies and to change tax structures and royalty rates. India has substantial resources of barite, bauxite, graphite, iron ore, and mineral sands.

Mineral resource revenues were a major factor in the robust annual economic growth rate of Indonesia, which had one of the world's broadest resource bases, including bauxite, coal, copper, gold, natural gas and petroleum, nickel, and tin. Construction began in October 1995 on Indonesia's first copper smelter-refinery at Gresik, near the industrial port of Surabaya on East Java.

The devastating earthquake on January 17, 1995, in the Kobe-Osaka area of Japan severely affected the minerals sector by damaging much of the infrastructure in the area. Iron and steel and affiliated galvanizing facilities were most affected, followed by lead and zinc smelting-refining facilities, and a steel rolling mill. Titanium sponge and high-purity silicon metal production facilities also were affected adversely. Although the impact on iron and steel production facilities was severe, operations returned to normal levels within 7 months; however, distribution networks for all mineral products were not repaired completely by yearend 1995.

In Papua New Guinea, the Government approved the long-awaited Special Mining Lease for the world-class gold project on Lihir Island in New Ireland Province, enabling development to begin at the remote mine site for mining by 1998.

The Philippines enacted a long-awaited, comprehensive, mining law during 1995. Along with the act passed in 1994 that reduced excise taxes, or royalty rates, on metallic and industrial minerals and quarry resources, this legislation enabled the domestic mining industry to regain its competitiveness by attracting international mining houses. As a result, applications for mineral exploration permits trebled during the year. Copper and refined gold continued to be the Philippines' most important mineral products, representing more than 30% each of the country's total mineral value.

The Government introduced new mining legislation in Vietnam to replace its 1989 ordinance on mineral resources. Enactment of the draft mineral law was expected by March 1996. It was to increase incentives for investment, covering exclusive rights, fixed-term exploration, environmental matters, and tax benefits and exemptions under certain conditions. The legislation also set a framework within which overseas mining companies investing in the country would be guaranteed the right to exploit the mineral resources found. Although the mining sector was still small and undeveloped, the country has a variety of exploitable mineral reserves.

Other significant resources are in many remaining countries of the Asia-Pacific region, including tin and associated titanium in Malaysia; copper, fluorspar, gold, and molybdenum in Mongolia; nickel in New Caledonia; gold and iron sands in New Zealand; magnesite in North Korea; copper in Papua New Guinea; chromite in the Philippines; and gemstones in Sri Lanka. Mineralization also may be in Burma (Myanmar), Cambodia, Laos, and Thailand; however, the mineral potential has not been evaluated fully in these areas. Overall, the region lacks large resources of petroleum; nevertheless, oil and gas occurs throughout the region, and commercial quantities are recovered in Australia, Brunei, Burma, China, India, Indonesia, and Malaysia. World-class-size coal deposits are in Australia, China, India, and Mongolia. There also is coal in Indonesia, which is becoming a major world exporter, New Zealand, North Korea, and Vietnam.

The Asia and Pacific region is a world-class producer of mined commodities and value-added mineral products. It produces more than 60% of the world's output of graphite, ilmenite, refined tin, rutile, and tungsten. About 40% to 60% of the world's output of alumina, barite, bauxite, cement, iodine, iron ore and pig iron, and manganese is from the area. In addition, the region accounts for 15% to 40% of the world's production of alumina and aluminum metal, mined and refined copper, fluorspar, gold, mined and refined lead, mercury, mined and refined nickel, salt, steel, and mined zinc.

Australia, China, Japan, and the newly industrialized economies of Asia and the Pacific continue to have important roles in the consumption of minerals and materials. Japan is by far the largest single consumer of fuels, minerals, and metals in the region. Most of Japan's consumption of raw materials is for the manufacture of finished goods for both domestic consumption and export. China also is a large consumer of fuels, minerals, and metals, largely producing end-products for internal use. Per capita consumption of minerals continues to be very low in China.

In the first half of the 1990's, consumption of aluminum, cadmium, copper, lead, nickel, and zinc in the Asia and Pacific region grew considerably owing to rapid growth in the economies of China and the six member countries of the Association of Southeast Asian Nations (ASEAN)–Brunei, Indonesia, Malaysia, Philippines, Singapore, and Thailand. In terms of quantity consumed, Japan ranked the highest, followed in order by China, the Republic of Korea, Taiwan, and India. However, in terms of demand growth rate, the ASEAN countries ranked the highest in the region. The high growth in demand for base metals by Indonesia, Malaysia, Singapore, and Thailand was partially attributable to the impressive growth of their economies and, to a greater extent, to the heavy overseas investment in manufacturing plants in the ASEAN countries by Japan, the Republic of Korea, and Taiwan. The regional consumption of aluminum, cadmium, copper, lead, and zinc as a percent of the world total consumption of these metals also registered considerable increases in the first half of the 1990's.

Major Sources of Information

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British Broadcasting Corp., London:
  Summary of World Broadcasts, Far East Weekly Economic Report.
British Sulphur Corp. Ltd., London:
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Fairchild Publications, New York:
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Far Eastern Economic Review, Hong Kong:
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  Review, weekly.
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  International Bulk Journal, monthly.
International Bauxite Association (IBA), Kingston Jamaica:
  IBA Quarterly Review.
International Lead and Zinc Study Group (ILZSG), London:
  ILZSG annual report.
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World Metal Statistics Yearbook.

TABLE 1
ASIA AND THE PACIFIC: PRODUCTION OF SELECTED MINERAL COMMODITIES, 1995

(Thousand metric tons unless otherwise specified)

Country	Aluminum			Barite	Cement	Coal		Copper		Fluorspar	Gold mine, Au content 1/	Graphite
	Bauxite	Alumina	Metal			Anthracite	Bituminous	Mine, Cu content	Refined, primary			
Afghanistan	--	--	--	2	115	--	185	5	--	--	--	--
Australia	42,655	13,147	1,297	11	6,500	--	239,578	437	327	--	254	--
Bangladesh	--	--	--	--	280	--	--	--	--	--	--	--
Bhutan	--	--	--	--	140	--	--	--	--	--	--	--
Brunei	--	--	--	--	--	--	--	--	--	--	--	--
Burma	--	--	--	35	517	--	32	4	--	--	(2/)	--
Cambodia	--	--	--	--	--	--	--	--	--	--	--	--
China	5,000	2,200	1,660	1,500	445,610	260,000	1,038,000	370	490	1,000	140	350
Fiji	--	--	--	--	78	--	--	--	--	--	4	--
Hong Kong	--	--	--	--	1,913	--	--	--	--	--	--	--
India	4,800	2,000	463	575	70,000	--	255,000	63	48	23	2	90
Indonesia	899	--	220	--	19,500	--	41,080	444	--	--	63	--
Japan	--	320	18	--	90,474	--	6,263	2	1,188	--	9	--
Korea, North	--	--	--	120	17,000	71,000	--	16	22	40	5	40
Korea, Republic of	--	--	--	(2/)	55,000	5,670	--	(2/)	235	(2/)	28	2
Laos	--	--	--	--	(2/)	--	--	--	--	--	--	--
Malaysia	184	--	--	17	10,600	--	112	22	--	--	3	--
Mongolia	--	--	--	--	109	--	500	100	--	180	--	--
Nepal	--	--	--	--	300	--	--	--	--	--	--	--
New Caledonia	--	--	--	--	100	--	--	--	--	--	--	--
New Zealand	--	--	273	--	700	--	3,000	--	--	--	13	--
Pakistan	8	--	--	15	8,586	--	2,997	--	--	3	--	--
Papua New Guinea	--	--	--	--	--	--	--	213	--	--	53	--
Philippines	--	--	--	500	9,800	--	1,320	106	192	--	27	--
Singapore	--	--	--	--	1,900	--	--	--	--	--	--	--
Sri Lanka	--	--	--	--	900	--	--	--	--	--	--	3
Taiwan	--	--	--	--	22,478	--	245	--	--	--	--	--
Thailand	--	--	--	59	26,500	5	--	--	--	53	--	--
Vietnam	--	--	--	--	7,500	7	--	--	--	--	--	--
Total	53,546	17,667	3,931	2,834	796,600	336,682	1,588,312	1,782	2,502	1,299	601	485
Share of world total, percent	49 6/	41	20	64	56	NA	NA	18	26	33	27	68
United States	W	4,530	3,375	543	78,320	4,250	861,950	1,850	1,929	51	320	--

See footnotes at end of table.

TABLE 1--Continued
ASIA AND THE PACIFIC: PRODUCTION OF SELECTED MINERAL COMMODITIES, 1995

(Thousand metric tons unless otherwise specified)

Country	Iodine	Iron			Lead		Magnesite	Manganese mine, Mn content	Mercury mine, Hg content 1/	Mica	Nickel	
		Ore, gross weight	Pig	Steel, crude	Mine, Pb content	Refined, primary					Mine, Ni content	Refined 3/
Afghanistan	--	--	--	--	--	--	--	--	--	--	--	--
Australia	--	142,936	7,475	8,493	455	215	280	1,066	--	--	101	82
Bangladesh	--	--	--	36	--	--	--	--	--	--	--	--
Bhutan	--	--	--	--	--	--	--	--	--	--	--	--
Brunei	--	--	--	--	--	--	--	--	--	--	--	--
Burma	--	--	--	--	2	2	--	(2/)	--	--	(2/)	--
Cambodia	--	--	--	--	--	--	--	--	--	--	--	--
China	5	249,350	101,700	92,970	430	400	1,000	5,000	540	--	37	38
Fiji	--	--	--	--	--	--	--	--	--	--	--	--
Hong Kong	--	--	--	350	--	--	--	--	--	--	--	--
India	--	59,000	18,626	20,291	28	35	400	627	--	--	--	--
Indonesia	(2/)	340	--	2,050	--	--	--	--	--	--	88	46
Japan	6	3	74,905	101,640	10	150	--	(2/)	--	--	--	64
Korea, North	--	11,000	6,600	8,100	80	75	1,600	--	--	--	--	--
Korea, Republic of	--	190	22,344	36,772	4	130	--	--	--	44	--	--
Laos	--	--	--	--	--	--	--	--	--	--	--	--
Malaysia	--	202	--	2,300	--	--	--	--	--	6	--	--
Mongolia	--	--	--	--	--	--	--	--	--	--	--	--
Nepal	--	--	--	--	--	--	--	--	--	--	--	--
New Caledonia	--	--	--	--	--	--	--	--	--	--	121	10
New Zealand	--	2,000	--	800	--	--	--	--	--	--	--	--
Pakistan	--	--	1,100	409	--	--	4	--	--	--	--	--
Papua New Guinea	--	--	--	--	--	--	--	--	--	--	--	--
Philippines	--	--	--	500	--	--	1	10	--	--	15	--
Singapore	--	--	--	--	--	--	--	--	--	--	--	--
Sri Lanka	--	--	--	--	--	--	--	--	--	(2/)	--	--
Taiwan	--	--	6,056	11,605	--	--	--	--	--	5	--	10
Thailand	--	34	--	1,500	10	--	--	(2/)	--	--	--	--
Vietnam	--	--	--	320	--	--	--	--	--	--	--	--
Total	11	465,055	238,806	288,136	1,019	1,007	3,285	3,285	540	55	362	250
Share of world total, percent	80	45	46	38	38	35	35 6/	43	19 6/	22	36	45
United States	1	62,489	50,900	95,172	394	374	W	--	W	108	2	--

See footnotes at end of table.

TABLE 1--Continued

ASIA AND THE PACIFIC: PRODUCTION OF SELECTED MINERAL COMMODITIES, 1995

(Thousand metric tons unless otherwise specified)

Country	Petroleum crude 4/	Natural gas 5/	Salt	Tin 1/		Titanium		Tungsten mine, W content 1/	Zinc	
				Mine, Sn content	Refined, primary	Ilmenite	Rutile		Mine, Zn content	Refined, primary
Afghanistan	--	2,600	13	--	--	--	--	--	--	--
Australia	200	30,000	8,480	8,175	570	1,979	200	10	930	332
Bangladesh	1	6,000	350	--	--	--	--	--	--	--
Bhutan	--	--	--	--	--	--	--	--	--	--
Brunei	58	9,600	--	--	--	--	--	--	--	--
Burma	4	1,476	260	747	190	--	--	531	1	--
Cambodia	--	--	40	--	--	--	--	--	--	--
China	1,100	17,000	24,990	52,000	60,700	160	--	21,000	950	1,050
Fiji	--	--	--	--	--	--	--	--	--	--
Hong Kong	--	--	--	--	--	--	--	--	--	--
India	250	16,000	9,503	--	--	300	14	2	157	146
Indonesia	580	82,070	670	38,378	38,628	--	--	--	--	--
Japan	5	2,209	1,400	--	630	--	--	--	95	574
Korea, North	--	--	590	--	--	--	--	900	210	200
Korea, Republic of	--	--	770	--	--	--	--	--	8	279
Laos	--	--	8	200	--	--	--	--	--	--
Malaysia	253	36,500	--	6,402	39,454	152	--	--	--	--
Mongolia	--	--	1	150	--	--	--	200	--	--
Nepal	--	--	7	--	--	--	--	--	--	--
New Caledonia	--	--	--	--	--	--	--	--	--	--
New Zealand	16	6	50	--	--	--	--	--	--	--
Pakistan	23	16,840	952	--	--	--	--	--	--	--
Papua New Guinea	--	--	--	--	--	--	--	--	--	--
Philippines	1	--	540	--	--	--	--	--	--	--
Singapore	--	--	--	--	--	--	--	--	--	--
Sri Lanka	--	--	60	--	--	60	2	--	--	--
Taiwan	(2/)	889	226	--	--	--	--	--	--	--
Thailand	8	11,389	480	2,201	8,243	--	--	92	20	46
Vietnam	--	--	375	4,500	2,800	--	--	--	15	10
Total	2,499	232,579	49,765	112,753	151,215	2,651	216	22,735	2,386	2,637
Share of world total, percent	11	8	26	60	72 6/	70 6/	70 6/	74 6/	34	63
United States	2,394	561,409	42,150	--	W	W	W	W	644	232

W Withheld to avoid disclosing company proprietary data. NA Not available.

1/ Metric tons.

2/ Less than 1/2 unit.

3/ Includes Ni content of intermediate products but excludes ferroalloy.

4/ Million 42-gallon barrels.

5/ Million cubic meters.

6/ Excludes U.S. production.

TABLE 2
ASIA AND THE PACIFIC: CONSUMPTION OF SELECTED METALS

(Thousand metric tons unless otherwise specified)

Country	Aluminum, primary		Cadmium 1/		Copper, refined		Lead, refined		Nickel		Tin, refined 1/		Zinc, slab	
	1991	1995	1991	1995	1991	1995	1991	1995	1991	1995	1991	1995	1991	1995
Australia	298	344	25	24	101	160	56	78	1	2	1,300	300	197	174
China	938	1,860	490	600	590	912	242	262	32	37	34,100	36,300	392	848
Hong Kong	37	117	(2/)	(2/)	6	19	1	1	(2/)	(2/)	5,800	--	11	6
India	430	579	446	446	96	114	78	80	15	13	3,000	1,200	130	192
Indonesia	90	148	(2/)	(2/)	49	85	40	91	(2/)	(2/)	1,300	2,000	48	73
Japan	2,432	2,336	6,371	8,364	1,613	1,415	422	334	180	196	34,900	28,100	846	752
Korea, Republic of	384	693	400	380	343	540	163	214	23	46	5,900	12,400	248	297
Malaysia	67	66	(2/)	(2/)	65	112	45	60	(2/)	(2/)	3,400	6,400	22	24
New Zealand	18	39	(2/)	(2/)	3	9	6	4	(2/)	(2/)	100	--	--	17
Philippines	17	23	(2/)	(2/)	22	55	20	26	(2/)	(2/)	300	100	31	40
Singapore	13	40	(2/)	(2/)	12	20	6	8	(2/)	(2/)	400	--	15	15
Taiwan	263	363	15	20	399	563	83	133	19	26	6,200	7,400	126	210
Thailand	147	240	(2/)	(2/)	67	148	41	62	(2/)	(2/)	4,400	5,600	75	100
Asia and the Pacific, unspecified	112	73	119	119	23	25	34	59	14	9	400	600	51	116
Total, Asia and the Pacific	5,246	6,921	7,866	9,953	3,389	4,177	1,237	1,412	284	329	101,500	100,400	2,192	2,864
Asia and the Pacific as a percent of World total	28	34	39	51	31	35	24	26	36	34	47	44	33	40
United States	4,330	5,055	3,343	2,008	2,058	2,530	1,246	1,472	799	148	35,300	34,600	933	1,202

1/ Metric tons.

2/ Included in Asia and the Pacific, unspecified.

Source: World Bureau of Metal Statistics. World Metal Statistics, July 1992 and July 1996.

THE MINERAL INDUSTRY OF

AFGHANISTAN

By Chin S. Kuo

Factional fighting around the capital city of Kabul temporarily stopped for 4 months in 1995 after 4 years of civil war. Since the mujahideen ousted the communist regime of President Najibullah in 1992, the city had been devastated by daily bombardments, and it required $65 million[1] to rehabilitate Kabul's electricity supply. The country's already weak infrastructure had been mostly ruined, particularly power generation and transportation, and economic development had been reduced to a minimum.

Iran was providing fuel and other assistance. About 30 United Nations and other international aid agencies were clearing the rubble, helping to reopen schools, setting up subsidized bakeries, installing water pumps, and providing materials so that homes could be rebuilt. But funds were scarce, and the international donors were not willing to commit to large-scale aid until the Afghans agreed to peace.

Afghanistan exported natural gas, precious and semiprecious gems and imported consumer goods, foodstuff, and petroleum products. Natural gas was the only economically important output. It was produced from Shiberghan and Sar-i-Pol and used for producing fertilizer and for generating electricity at Mazar-e-Sharif. Annual output was around 2.4 billion cubic meters. Natural gas was exported to Uzbekistan by pipeline. Lapis lazuli, though best known for the country, was of less significance.

Other mineral resources known to have been found in the country included barite, coal, copper, iron ore, lead, petroleum, precious and semiprecious stones, salt, sulfur, talc, and zinc. Coal deposits occur mostly in the north from Herat to Badakshan. Rich reserves of iron ore were discovered years ago at the Hajigak hills in Bamyan Province.

Afghanistan has never been a significant producer of any mineral commodity. Mineral development had been severely hampered by then insurgent warfare and now civil fighting. A cement plant was in operation with a capacity of 115,000 metric tons per year (t/yr). Copper was produced at Ainak at a level well below capacity. Coal output was around 300,000 t/yr. *(See table 1.)*

Major Sources of Information

Ministry of Mines and Industries
  Kabul, Afghanistan
Ministry of Water and Electricity
  Kabul, Afghanistan

TABLE 1
AFGHANISTAN: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
Barite		2,000	2,000	2,000	2,000	2,000
Cement, hydraulic		112,000	115,000	115,000	115,000	115,000
Coal, bituminous		170,000	175,000	180,000	180,000	185,000
Copper, mine output, Cu content		5,000	5,000	5,000	5,000	5,000
Gas, natural:						
Gross	million cubic meters	2,500	2,600	2,700	2,700	2,600
Marketed	do.	2,200	2,300	2,300	2,300	2,200
Gypsum		3,000	3,000	3,000	3,000	3,000
Natural gas liquids	thousand 42-gallon barrels	35	35	35	40	40
Nitrogen, N content of ammonia		40,000	40,000	30,000	30,000	30,000
Salt, rock		12,000	12,000	13,000	13,000	13,000

e/ Estimated.
1/ Table includes data available through Aug. 21, 1996.
2/ In addition to the commodities listed, asbestos, lapis lazuli, uranium, and a variety of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but available information is inadequate to make reliable estimates of output levels.

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[1] Where necessary, values have been converted from Afghan afghanis (Af) to U.S. dollars at the rate of Af1,900=US$1.00 for 1995.

THE MINERAL INDUSTRY OF

AUSTRALIA

By Travis Q. Lyday

Australia was estimated to be the third largest producer of minerals and metals (excluding coal and petroleum) in the world in 1995, and its minerals industry was a leading catalyst in promoting growth of the country. In 1995, Australia was the world's leading producer of alumina, bauxite, diamond, ilmenite, lead, monazite, opal, rutile, sapphire, and zircon. It was the third largest producer of gold and zinc, and the fourth largest producer of cobalt, iron ore, and uranium. Australia was the fifth largest producer of coal and nickel in the world. It was the premier exporter of alumina, coal, ilmenite, iron ore, refined lead, monazite, rutile, and zircon. The country's mineral wealth was so extraordinary that it was virtually self-sufficient in most mineral commodities. The only significant mineral resource in which Australia was not self-sufficient was petroleum. Nevertheless, Australia still produced about 75% of its crude oil requirements domestically. However, the country was endowed with abundant resources of other mineral fuels including coal, natural gas, liquefied petroleum gas, and uranium and continued to be one of the few market economy countries that was a net exporter of mineral fuels.

Although the Australian mineral industry dates back to coal and copper mining shortly after the first European settlements in 1788, the country's mining industry did not come into its own until the gold rushes of the 1850's in New South Wales (NSW), Queensland (QLD), Victoria (VIC), and Western Australia (WA); the lead-silver-zinc discoveries at Broken Hill, NSW, in 1883; and the Mount Isa, QLD, lead-silver-zinc and copper finds 50 years later. Further discoveries followed, and, since the mid-1960's, Australia has become a major world producer of a number of minerals.

The minerals industry, the largest primary sector of the economy, remained heavily export-oriented, with about 80% of the value of its mineral production destined for international markets. Mineral exports were heavily concentrated into just four commodity groups: alumina, aluminum, and bauxite; coal; gold; and iron ore.

Government Policies and Programs

In March, Australia's High Court rejected the Government of WA's Land Titles and Traditional Usage Act that challenged the Federal Government's Native Title Act (NTA) of 1993. The NTA had established that the native Aboriginal people still retained, in some circumstances, ownership of land, whereas WA's legislation offered, in place of native ownership, much weaker rights of traditional usage, such as use for ceremonial purposes. With the rejection, the High Court reaffirmed its two previous decisions of 1988 and 1992 that explicitly invalidated the notion that Australia was *terra nullius*—belonging to no one—at the time of European settlement.[1]

The Commonwealth Scientific and Industrial Research Organization was developing a new mineral exploration technique known as spaceborne technology that would be used to create mineral maps to aid the Australian mining industry in discovering new mineral deposits.[2]

The Commonwealth Government in February abandoned its proposals for the introduction of a carbon tax as part of a greenhouse gas package following widespread industry and State Government opposition. The proposal for a levy of $0.94 per metric ton (t) on industry was expected to raise about $750 million over 3 years. Instead, the Government was looking to the corporate sector to deliver on commitments that greenhouse gases such as carbon dioxide, chlorofluorocarbons, and methane can be reduced through greater energy efficiency and other cooperative measures.[3]

Environmental Issues

Australia's Federal Government initiated in October a "Greenhouse Challenge," a joint Government-industry program designed to assist Australian industry in the reduction of greenhouse gas emissions. The program was part of the Government's National Greenhouse Response Strategy.[4]

Production

The value of minerals produced in Australia in fiscal year (FY) 1995[5] was estimated to have increased 5%, to $22.3 billion,[6] over the $21.2 billion of 1994. Metallic mineral production contributed an estimated 40% of the total, followed by petroleum (crude oil, natural gas, and natural gas liquids) production, 30%; coal production, 25%; and industrial minerals production, including clays, construction materials, dimension stone, peat, and salt, 5%. The value of downstream production, including smelting and refining, was estimated also to have increased 5% in FY 1995 over that of FY 1994.

Australia remained the world's leading producer of alumina, bauxite, diamond, ilmenite, monazite, opal, rutile, sapphire, and zircon in calendar year 1995. The country also continued to rank among the world's top producers of aluminum, antimony, coal, cobalt, copper, gold, iron ore, lead, manganese, mined and refined nickel, salt, silver, tin, uranium, and mined zinc. *(See table 1.)*

Trade

Australia continued to rely heavily on the export of the majority of its mineral production to bolster economic growth.

The value of its mineral exports in FY 1995 increased about 7.5%, to $22.4 billion, from the $20.8 billion set in FY 1994, and the minerals industry remained Australia's largest export earner, accounting for about 60% of commodity export earnings. An estimated 80% of Australia's mineral production was exported. Australia remained the premier exporter of alumina, coal, ilmenite, iron ore, refined lead, monazite, rutile, and zircon. While using its plentiful resources of energy minerals (coal, liquefied natural gas, and uranium), Australia also continued to be a net exporter of mineral fuels, thus enabling the country to retain a favorable trade balance in energy products.

Coal remained Australia's largest mineral export earner in 1995, followed by gold, iron ore, and bauxite, respectively. Annually, Australia exports about 70% of its coal production, accounting for about 30% of world coal trade; more than 90% of the gold it produces; about 90% of its iron ore production, also representing about 30% of world trade; and 80% of its aluminum production, composing more than 10% of world trade. The richness and diversity of the Australian minerals sector provided a significant portion of the gross domestic product, contributing an estimated 50% of the country's export earnings in FY 1995.

Structure of the Mineral Industry

The Australian minerals industry covers nearly the whole spectrum of minerals, from major industrial minerals (ilmenite, rutile, and zircon), base metals (copper, lead, and zinc), ferrous metals (iron ore, manganese, and nickel), nonferrous metals (aluminum and tin), precious metals (gold and silver), fuel minerals (coal and uranium), to gemstones (diamond, opal, and sapphire). Australia was one of the world's principal producers and suppliers of ores, concentrates, and refined metals. Australia was estimated to rank third in the world in the value of nonfuel mineral production. The value of mineral production, including fuels, was estimated to rank eighth in the world.

The Australian mining industry was based on a system of free enterprise, with private companies involved in exploration, mine development, production, mineral processing, and marketing. A number of foreign companies in mineral ventures in Australia were affiliates or subsidiaries of U.S. companies. Foreign companies controlled a majority of the mining, smelting, and refining sectors and a significant portion of the petroleum and natural gas sectors.

Many of Australia's mineral industries were fully integrated, producing ores, concentrates and other intermediate products (e.g., alumina), and refined metal or other end products (e.g., cut-and-polished gem diamond) within the country. In 1995, there were six alumina refineries and aluminum smelters each; three principal copper smelters and refineries each; one principal gold refinery; four principal lead-zinc smelters and/or refineries; one manganese ferroalloys plant; one nickel smelter and two nickel refineries; three principal crude steel plants; one primary tin smelter and refinery each and two secondary tin refineries; and two silver refineries. Australia had eight principal petroleum refineries.

Ownership of mineral rights in Australia was divided between State ownership in State onshore areas and Commonwealth, or Federal, ownership in Territories and in offshore areas beyond the territorial limit. However, the Commonwealth's responsibility for minerals in the Northern Territory (NT), except for uranium, has been transferred to the government of the NT. Thus, the individual States and Territories administered the minerals industries within their own borders, including registering of land titles; issuing exploration and development permits; overseeing mining operations, including administration of inspections; assuring compliance with health, safety, and environmental regulations; and levying royalties and taxes.

The Federal Government may restrict mineral exports for the good of the country and therefore had de facto control over most mineral production. *(See table 2.)*

Commodity Review

Metals

Bauxite, Alumina, and Aluminum.—Australia again was the unchallenged world leader in bauxite production for the 25th consecutive year, producing almost 45% of the production of market economy countries. All mining continued to be from the opencut operations at Weipa on the western flank of the Cape York Peninsula in the far north of QLD; the Gove operation across the Gulf of Carpentaria in northeastern Arnhem Land, NT; and from the mines south of Perth in the Darling Ranges, WA. Although substantial bauxite deposits also were known to occur bordering Admiralty Gulf at Cape Bougainville and in the nearby Mitchell Plateau area of the Kimberley region of northern WA, their remoteness from energy supplies and infrastructure continues to impede development.

Australia also was dominate in the world alumina market, producing from six refineries more than one-third of world production. The NT and QLD each had one refinery; the remaining four were in WA.

Australia was a significant supplier of aluminum as well. Aluminum was produced at six smelters, two each operating in NSW and VIC, and one each operating in QLD and Tasmania (TAS).

Comalco Ltd. began in midyear construction of a third potline at its majority-owned Boyne Island Smelter south of Gladstone in QLD. The 229,000-metric-ton-per-year (t/yr) potline, scheduled for completion in October 1997, would expand the capacity of the facility from 260,000 t/yr to 479,000 t/yr, making it one of the largest aluminum plants in the world. The plant was to reach full capacity by April 1998.[7]

Comalco achieved an agreement in November with the Tasmanian Government and the Hydro Electric Commission of Tasmania covering a power supply contract for its Bell Bay, TAS, smelter that effectively would extend the smelter's life until at least the year 2014. Although further issues still were to be negotiated prior to the formal signing of the contract in 1996, the agreement paved the way for Comalco to commit to upgrading the environmental performance, safety, process performance, and competitiveness of the smelter by 2002.[8] Under the new contract, a further 19 megawatts (MW) of power was to be provided, taking the total available to 256 MW, and enabling production capacity from the existing potlines to be increased by more than 15%, to 140,000 t/yr. Comalco planned to install dry-scrubbing technology as part of its environmental improvement program.[9]

Capral Aluminium Ltd., formerly Alcan Australia Ltd., purchased at the end of November the rolling, extruding, and distributing businesses of Comalco, making Capral by far the largest downstream manufacturer and distributor of aluminum products in the country. Capral produced about one-half of Australia's estimated 50,000-t/yr extrusion output from its own 155,000-t/yr smelter at Kurri Kurri in NSW. The divestiture of Comalco's downstream processing facilities enabled it to concentrate its efforts to improve its position as a world-class producer of bauxite, alumina, and primary aluminum at its upstream processing facilities.[10]

Chromium.—Dragon Mining NL began early in the year a feasibility study for mining high-iron chromite from Australia's largest known chromium deposit, the lateritic ore body containing an estimated 500,000 t of chromite ore, at Range Well in WA.[11] Dragon Mining, in joint venture with the major engineering firm Clough Mining Services, was planning to develop a plant to manufacture chrome grinding balls for use in both the mining and processing industries.[12]

Cobalt.—Australia was the fourth largest producer of cobalt in the world, with output produced as a byproduct of nickel mining and processing. Australia's sole cobalt processor was QNI Ltd., processing laterite nickel-cobalt ores at its Yabulu nickel refinery near Townsville, QLD, for the production of cobalt sulfide. The refinery's feedstock was ore imported from Gebe Island, Indonesia, and La Grande Terre, the main island of New Caledonia, that was blended with domestically produced ores mined at QNI's Brolga Mine and from stockpiled ore from the Greenvale Mine, both in QLD. The Greenvale Mine, 225 kilometers (km) west of Townsville at Marlborough, was depleted in 1992.

QNI awarded in October a contract for the construction of a cobalt plant at its Yabulu Refinery to manufacture pure cobalt oxide hydroxide. The plant was due to be completed in November 1996.[13] The refinery was producing about 1.36 million kilograms per year (kg/yr) of cobalt metal in sulfides as a byproduct, all of which was sold to Kokkola of Finland under long-term contract, but this was to end with the startup early in January 1997 of the facility when QNI stopped producing cobalt sulfides.[14]

Western Mining Corp. Holdings Ltd. (WMC) and Finland's Outokumpu Oy mined byproduct cobalt from their nickel sulfide mines in WA.

MIM Holdings Ltd., in joint venture with Savage Resources Ltd., was assessing the feasibility of producing cobalt associated with copper from the partnership's Ernest Henry copper-gold project in northwestern QLD. The Ernest Henry Mine was expected to start production late in 1997. MIM Holdings also was considering equipping its base metal mine at Mount Isa, QLD, to separate cobalt from copper.[15]

Copper.—Mine production of copper in Australia continued to be from operations that produced other metals, either as the primary product or as a coproduct. The most notable copper-producing operations were at Mount Isa (Hilton copper-lead-zinc mine), QLD, and Roxby Downs Station (Olympic Dam copper-gold-uranium mine), South Australia (SA).

WMC's copper output grew by almost 20,000 t/yr following the completion in midyear of the optimization program at its Olympic Dam polymetallic mine and refinery at Roxby Downs Station. The program involved the construction of a new shaft, the Robinson, and associated underground loading equipment; a new fully autogenous grinding mill, the largest in Australia; and additional thickening and leaching equipment, adding additional flotation capacity. The $55-million production optimization program was started in 1993 and increased copper output from 66,000 t/yr to 84,000 t/yr.[16]

Placer Pacific Ltd. diversified into the copper sector when the company began on August 1 its first commercial production of copper concentrate from the Osborne Mine, 160 km south of Cloncurry, in northern QLD. Previously, Placer Pacific produced only gold and byproduct silver through its holdings in such operations as the Kidston Mine, QLD; the Granny Smith Mine, WA; and the Misima and Porgera Mines in Papua New Guinea. All of the copper concentrate production was to be exported, with about one-half going to Japanese smelters.[17] In November, Placer Pacific committed itself to expand the Osborne Mine's capacity by developing via a decline from the initial open pit a 1-million-ton-per-year (Mt/yr) underground operation, which was to increase the mine's life to a minimum of 11 years, producing annually 29,000 t of copper-in-concentrate and almost 1,200 kilograms (kg) of gold.

Development of the Mount Lyell copper-gold mine on the west coast of TAS near Queenstown progressed as planned during the year, and Gold Mines of Australia Ltd. (GMA) was able to restart mining and commence concentrate production in November. The mine was officially reopened on December 15, producing more than 3,000 t of copper-gold concentrate by yearend. GMA had been awarded the leases for the 101-year-old mine by the Tasmanian Government following Renison Goldfield Consolidated Ltd.'s (RGC) withdrawal at yearend 1994. Production at Mount Lyell was to increase from its initial 1995 rate of about 1.5 Mt/yr of ore to 3.5 Mt/yr over a 3-year period, taking copper-in-concentrate production from 16,200 t/yr to 39,000 t/yr by 1998.[18] GMA secured in August a 10-year agreement to supply copper concentrate to Swiss-based commodity trading house Glencore International AG (formerly Marc Rich).[19]

Cloncurry Mining NL reopened in November the Great Australia Mine in Cloncurry, QLD, after being closed for 70 years. The mine originally was discovered in 1867, with Cloncurry acquiring the exploration tenement containing the mine in 1991. Cloncurry was planning to mine and stack 110,000 t of ore prior to starting heap-leach operations in February 1996. The operation was expected to produce 5,500 t/yr of copper cathode over an expected mine life of 8 years.[20]

MIM Holdings and partner Savage Resources announced in November that it would proceed with development of the Ernest Henry copper-gold mine in northwestern QLD following the granting of key mining leases by the State government. The mine was expected to be in production late in 1997. Plans were for a 15-year mine life with production averaging 95,000 t/yr copper.[21] It was expected that all of the output would be treated at the smelter at Mount Isa and the refinery in Townsville, but the partners had not finalized their plans by yearend and some of the concentrate may be exported.[22]

Gold.—Gold was mined in all States and Territories except the Australian Capital Territory (ACT). In 1995, WA remained the premier gold producer, producing more than 75% of the country's production, followed by QLD and the NT, respectively.

Gold Corp. of Australia, an agency of the State of WA, closed at the end of January its Kalgoorlie Refinery and centralized its refining operations at its Newburn Refinery in Perth. The primary reason for the closure was the shift in global demand from the 99.5%-pure gold produced at Kalgoorlie towards gold of 99.99% purity, which Kalgoorlie was unable to produce. Another reason for the plant's closure was the 40% reduction in refining fees per ounce of gold at Kalgoorlie since 1990.[23]

Following the granting of mining leases by the QLD government, joint-venture partners MIM Holdings and Savage Resources decided in November to proceed with development of the Ernest Henry copper-gold mine in the northwestern part of the State. The mine was expected to average 3,700 kg/yr of coproduct gold over the 15-year life of the mine.

GMA restarted in November mining and milling operations at its Mount Lyell copper-gold mine near Queenstown, TAS. The mine, officially reopened on December 15, produced more than 3,000 t of copper-gold concentrate by yearend. GMA took possession of the mining leases following RGC's withdrawal from the operation at yearend 1994. Production at Mount Lyell was to increase from its initial 1995 rate of about 1.5 Mt/yr of ore to 3.5 Mt/yr over a 3-year period, taking gold production from less than 400 kg/yr to about 900 kg/yr at full production.[24]

Eagle Mining Corp. NL had its inaugural gold pour at the end of December at its Nimary Mine, near Wiluna in WA. Construction and Development of the mine had taken just 5 months, with low-grade ore being fed to the recovery plant in mid-December. At full capacity, planned to be achieved early in 1996, Nimary was expected to produce more than 3,100 kg/yr of gold over the project's life of 5-plus years.[25]

Iron Ore and Steel.—Australia remained the world's leading iron ore exporter in 1995 for the fifth consecutive year. As a world producer, Australia ranked fourth behind China, Brazil, and the former Soviet Union. Australian iron ore production continued to be heavily concentrated in the Hamersley Range of the Pilbara District, WA, which accounted for more than 96% of the country's production. Iron ore also was produced by BHP Steel Pty. Ltd. at its Iron Duke and Iron Knob Mines in the South Middleback Ranges near Whyalla, SA, and at the Savage River Mine in northwestern TAS.

BHP Steel began in June a $70-million upgrade of its Port Kembla, NSW, steelworks, to increase output of slabs by 400,000 t/yr, to 5 Mt/yr. The upgrade also was supporting BHP Steel's growth plans in the production of hot-rolled strip, plate, and feed for its packaging products plant, also undergoing an upgrade and expansion program, while maximizing the potential of the No. 6 blast furnace scheduled for commissioning in March 1996.[26]

The South Australia Steel and Energy joint-venture led by Meekatharra Minerals Ltd., with Ausmelt Ltd. and the government of SA, was in the initial stages at yearend of planning the development of a 4-Mt/yr iron ore mine and the subsequent development of a 2.5-Mt/yr pig iron plant, both in SA. Exports of the iron ore were initially to be from ports in SA, although it was being planned that the iron ore would be transported north by train for shipment out of Darwin in the NT. Startup of the iron works was to be in late 1998 or early 1999 using coal from Meekatharra's mines.[27]

BHP Steel was the only integrated steel producer in Australia during the year. BHP Steel's contribution to total world steel output, however, was relatively small, having just three steelworks that produced less than 1% of world production. BHP Steel's plants were at Newcastle and Port Kembla in NSW and Whyalla in SA.

BHP Minerals Pty. Ltd. began construction in midyear of its 2-Mt/yr direct-reduced iron (DRI)—hot-briqueted iron (HBI) processing plant at Port Hedland, WA. The plant was to incorporate direct reduction technology using the FINMET process developed by Venezuela's Siderurgica Venezolana and Austria's Voest-Alpine Industrieanlagenbai in which iron ore fines are directly reduced using hot, reformed natural gas under pressure in multistage fluidized bed reactors.[28]

Following a favorable feasibility study, privately owned Brisbane-based Minerals Ltd. announced at midyear it would proceed with development of its Fortescue iron ore project in the Dampier-Karratha area of the Hamersley Basin, WA. The Fortescue project, expected to begin production late in 1998 or early 1999, initially was to produce 4 Mt/yr of DRI and 6 Mt/yr of pellets at a processing plant near the coast supplied by a low-grade, magnetite-rich banded iron formation (BIF) mine about 80 km inland in the western end of the Pilbara District. DRI production eventually was to increase to 20 Mt/yr. The BIF ore was to be transported by slurry pipeline from the mine to the plant, then shipped in the form of HBI. Customers mainly would be electric-arc furnace steelmakers in China and Southeast Asia. In addition to the mine and plant, the project also included construction of a power station and port facilities.[29]

Lead and Zinc.—Most lead and zinc mined in Australia was from operations that produced both because the two metals commonly occur in the same deposits. Zinc was the main product in almost all of Australia's lead-zinc mining operations.

Australia ranked first in the production of lead concentrates and third in the production of zinc concentrates, producing, respectively, about 16% and 13% of the world's total in 1995. In refined production, Australia ranked eighth in lead and seventh in zinc in 1995.[30]

MIM Holdings' 70%-owned world-class-size McArthur River underground lead-zinc-silver project started mining ore in February 1995 and began milling operations in June. The McArthur River Mine is 120 km inland from the Gulf of Carpentaria in eastern NT and 230 km west of the QLD border, approximately midway between NT's capital at Darwin and MIM Holdings' Mount Isa Mine in northern QLD. The mine, operated by McArthur River Mining Pty. Ltd., was on schedule to reach its full mining capacity of 1.5 Mt/yr of ore by mid-1996. The mine's design capacity was 350,000 t/yr of high-grade bulk concentrate containing 45,000 t of lead, 160,000 t of zinc, and 50,000 kg of silver. The concentrate was to be transported 120 km by road to Bing Bong on the Gulf of Carpentaria coast and barged to ships moored 30 km offshore for export to overseas smelters. Up to one-half of the mine's output was slated to be sent to MIM Holdings' European smelters, Britannia Zinc Ltd. in Avonmouth, England, and MIM Huttenwerke in Duisburg, Germany. Of the remaining output, two Japanese smelters were to purchase about one-half, and the rest was scheduled to go to Pasminco Ltd.'s Cockle Creek Smelter near Newcastle, NSW, and two other European plants, Metaleurop in France and Enirisorse in Sardinia.[31]

CRA Ltd. formally committed itself in December to develop its Century lead-zinc deposit, 250 km northwest of Mount Isa, QLD. Development was subject to final agreement of the local Aboriginal communities, whose environmental, welfare, and cultural concerns were outstanding issues under negotiation for several months during the year. The Century Mine was to be operated by Century Zinc Ltd., a wholly owned subsidiary of CRA. A timely settlement with the local communities was essential so that CRA could meet an early 1998 contract deadline to provide the necessary low-iron concentrates to Pasminco's 205,000-t/yr Budel Zink smelter in the Netherlands, without which the Budel facility would be forced to close under Dutch law because of environmental infringements—Budel had to halt its disposal of jarosite waste generated during the smelting process.[32] Planned annual production at the Century Mine was to be 450,000 t/yr zinc-in-concentrate and 40,200 t/yr lead-in-concentrate beginning early in 1998. Production was to be transported in slurry form through a pipeline to storage and loading facilities at Karumba on the Gulf of Carpentaria, 300 km distant. From Karumba, it was to be barged to vessels anchored offshore for shipment overseas.[33]

Pasminco received in November approval from the NSW Government to upgrade its Cockle Creek zinc smelter at Boolaroo, near Newcastle in the Hunter Valley region of the State. The refurbishing was to include immediate improvements in environmental aspects of the smelting process that also would reduce costs, and a later increase in smelting capacity, scheduled to be done when the furnace undergoes a major maintenance program in 1997. The expansion would increase production from 80,000 t/yr to 110,000 t/yr.[34]

The Republic of Korea's Korea Zinc Co. Ltd. announced at yearend that it would proceed with construction of a zinc smelting plant at Townsville, QLD. The 2-phase project was to commence in midyear 1996 with construction of a 170,000-t/yr capacity smelter scheduled to come on-stream in 1999. The second phase of the project, beginning about 2004, was to double the capacity of the plant.[35]

Manganese.—Groote Eylandt Mining Co. Pty. Ltd.'s (GEMCO) opencut manganese mine on the northwest portion of Groote Eylandt, off the far north coast of Australia in the west of the Gulf of Carpentaria, was the second biggest mining operation in the NT, after the Gove bauxite mine, and was the world's third largest manganese producer, representing about 10% of production. GEMCO ships annually about one-quarter of its approximate 2 million metric tons (Mt) of concentrate to the ferromanganese plant operated by Tasmanian Electro Metallurgical Co. Pty. Ltd. (TEMCO) at Bell Bay, TAS. Both GEMCO and TEMCO were wholly owned subsidiaries of BHP Minerals. Smaller quantities were used in Australian Manganese Co. Pty. Ltd.'s electrolytic manganese dioxide (EMD) plant at Newcastle, NSW, for the production of high-grade material used in long-life batteries. Australian Manganese also was a wholly owned subsidiary of BHP Minerals.

In April, Portman Mining Ltd. reopened its Woodie Woodie operation, near Nullagine in the Pilbara region of WA, following the successful negotiation of sales contracts to supply 200,000 t of metallurgical-grade manganese to the Japanese market during the Japanese FY 1995.[36] Portman Mining had placed the operation on care-and-maintenance in 1994 because of low ore prices.

Valiant Consolidated Ltd. was Australia's only other manganese miner, producing about 80,000 t of high-grade ore from its Mike Mine at Pearana Rock Hole, also in the Pilbara region.

Formal opening was conducted in April of an expansion that raised annual EMD capacity at Australian Manganese's Newcastle plant to more than 22,000 t.

Mineral Sands.—Australia's mineral sands industry included the mining and processing of high concentrations of the heavy minerals ilmenite, leucoxene, monazite, rutile, and zircon. Australia was the world's leading producer and exporter of mineral sands. Australia's mineral sands industry produced about 40% of the ilmenite, 35% of the rutile, 50% of the zircon, and a substantial portion of the world's monazite.

Westralian Sands Ltd. announced in March that it would proceed with the construction of a synthetic rutile plant at North Capel that would double to 230,000 t the annual production capacity. Westralian Sands previously had secured the necessary approvals for the expansion, keeping the project on hold until more suitable market conditions were evident. The new plant was to feature innovative energy savings measures, including using heat from an ilmenite reduction kiln to generate 6 MW of electricity—most of the power requirement for production of synthetic rutile at North Capel.[37]

RZM Pty. Ltd. was forced to close in August its Tomago, NSW, mineral sands milling operations. The closure was precipitated by delays in obtaining from the National Parks and Wildlife Service (NPWS) extended mining permits on environmental grounds for the Tomago area operations that supply the dry processing plant. RZM declared *force majeure* (inevitable accident or Act of God) for the first time in its 32-year operating history at the end of October when its stocks of heavy-mineral concentrates became exhausted because of the mining interruption. It was expected at yearend that milling would recommence late in the first quarter 1996, following a decision by the NPWS on the mining leases. The annual crude output from the Tomago mill prior to closure was 30,000 t of rutile and 30,000 t of zircon.[38]

In November, the WA State government approved Tiwest Joint Venture's planned expansion of its TiO_2 plant at Kwinana, near Perth in WA. The project was to increase capacity from 64,000 t/yr to 80,000 t/yr. Tiwest was a 50-50 joint venture of Ticor Resources Pty. Ltd. and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., a subsidiary of Kerr-McGee Chemical Corp. of the United States. Tiwest began Australia's first minerals-to-pigment project in 1988.[39]

Nickel.—The Australian nickel mining industry in 1995 consisted of several mines operating near the communities of Forrestania, Kambalda, Leinster, and Mount Keith in WA and the Brolga mining operation near Marlborough, QLD. Downstream processing occurred at the Kalgoorlie Smelter in WA and at refineries at Kwinana, WA, and Yabulu, near Townsville, QLD. Australia was the world's fifth largest producer of mined nickel, behind Russia, Canada, New Caledonia, and Indonesia. It was the world's fourth largest producer of nickel metal, trailing Russia, Japan, and Canada. WMC was the country's dominant nickel miner and main nickel metal producer from its mining and processing operations in WA.

WMC was planning to raise the annual capacity at its Mount Keith Mine from 28,000 t/yr to 42,000 t/yr in a 2-stage expansion. The Mount Keith Mine was a part of the Leinster-Mount Keith Nickel Operations, an administrative division formed during the year to combine the Leinster Nickel Operations with the Mount Keith operation that was commissioned in October 1994. Output in the first stage was to be expanded from 37,000 to 38,000 t/yr of contained metal by May and to 42,000 t/yr by yearend 1996, with ore throughput targeted to rise from 8 Mt/yr to 10 Mt/yr.[40]

Defiance Mining NL was expecting to deliver from its Carr Boyd Mine its first shipment of nickel concentrates to WMC's Kalgoorlie Smelter early in 1996 following an agreement under which WMC was to purchase all the nickel concentrate produced at the developing Carr Boyd nickel project. Defiance Mining's plans included dismantling the 250,000-t/yr plant at nearby Paringa for relocation to Carr Boyd to initially process 150,000 t/yr of ore to produce 20,000 t/yr of nickel concentrates. The Carr Boyd project is 75 km north of Kalgoorlie.[41]

Platinum-Group Metals.—No Australian mines were primary producers of platinum-group metals (PGM) in 1995, although minor production continued in WA's Eastern Goldfields at Kalgoorlie-Boulder and Kambalda as a byproduct of the nickel operations. PGM, mainly platinum and palladium, were recovered at the Port Kembla, NSW, refinery-smelter complex from byproduct copper sulfide residue produced at the Kwinana nickel refinery. PGM also were contained in nickel matte produced for export at the Kalgoorlie smelter.

Silver.—Australia was a major silver producer, ranking among the world's top five producers in 1995. Almost all of the country's production, however, was as a byproduct of copper-gold, gold, or lead-zinc mining.

MIM Holdings' 70%-owned McArthur River Mine in eastern NT began commercial production of silver in midyear. Upon reaching in mid-1996 its full capacity, the operation was scheduled to produce almost 50 t/yr of silver, about 5% of Australia's annual production.

East Coast Minerals NL was planning development of its Elizabeth Hill primary silver deposit, believed to be one of the country's richest, in the Munni Munni region of the Pilbara in WA. Archaean Gold NL announced a high-grade silver, low-grade gold discovery at Boorara, near Kalgoorlie in WA, that reportedly could produce up to 450 t/yr of silver.[42]

Tin.—RGC's Renison Bell Mine near Zeehan, TAS, was the world's largest hard-rock underground tin mine and Australia's main tin producer. Gwalia Consolidated Ltd.'s Greenbushes Mine in southwestern WA also produced tin as a coproduct of its spodumene and tantalite mining.

Norminco Ltd. began tin production in October from its reactivated tin operation in the Leichhardt Creek district of the North QLD tin fields, about 70 km west of Cairns. Production initially was to be about 600 t/yr of tin in a high-grade alluvial concentrate. All of the output was sold to Malaysia Smelting Corp. Bhd. for treatment. Norminco was considering constructing a second plant at the site that would add about 1,000 t of additional capacity to the project. A feasibility study was in progress at yearend. Ultimately, Norminco was aiming to increase production to more than 3,000 t/yr as further plants came on-stream.[43] Norminco changed its name from Mount Carrington Mines Ltd. following Mount Carrington's acquisition of Norminco Pty. Ltd.

Industrial Minerals

Cement.—Five industrial conglomerates produced almost all of the country's cement capacity from a multitude of plants around the country in which they held a large share percentage. Adelaide Brighton Ltd. held the most capacity, about 2.1 Mt/yr and 29% of total capacity; Blue Circle Southern Cement Ltd. had about 2 Mt/yr of capacity (28%); Australian Cement Holdings Ltd. operated plants with about 1.4 Mt/yr, about 20% of the country's capacity; Queensland Cement Ltd. operated plants having about 1.3 Mt/yr of capacity, or 18%; and Cockburn Cement Ltd. held 0.3 Mt, about 4% of annual capacity.[44]

Diamond.—Australia has been since 1986 the world's largest producer of natural diamond in terms of carats recovered, but only a relatively small portion of its output is of gem quality, reflecting the country's sixth ranking in terms of value of world diamond production.[45] The majority of production was derived from the AK-1 lamproite pipe and alluvial operations at the mammoth Argyle Mine in the Kimberley region of WA, which retained its position for the tenth consecutive year as the world's biggest single-mine producer of diamond with output equivalent to about 40% of world production. About 5% of production was of gem quality, including a small proportion of the highly valued intensely pink stones that generated about 50% of revenues; 40% was near-gem quality that produced about 45% of revenues; and 55% was industrial quality that contributed just 5% of revenues.[46]

Argyle Diamond Mines Pty. Ltd. (ADM) was the management company and operator of Argyle Diamond Mines Joint Venture's (ADMJV) Argyle Mine; the ADMJV itself was comprised of the newly merged RTZ Ltd.-CRA Ltd. companies, 56.8%, Ashton Mining Ltd., 38.2, and Western Australia Diamond Trust, 5%. ADMJV continued to sell most of its gem and 78% of its near-gem quality white diamonds to De Beers' Central Selling Organization (CSO) under a 5-year marketing contract that was scheduled to expire on June 30, 1996, through Argyle Diamond Sales Pty. Ltd. (ADS), a company jointly owned on the same basis as the mine by the joint-venture companies. ADMJV retained the right to sell the few handfuls of the very rare, intensely pink *Argyle Pink* diamonds unique to the Argyle Mine, as well as the more common yellow-to-brown stones, which were marketed as *Argyle Champagne* or *Argyle Cognac* diamonds, depending upon the specific color. These diamonds were cut and polished using traditional techniques and automated laser cutting machines at ADS's small facility in West Perth. Most of the remaining portion of the near-gem quality and all of the industrial-grade stones were sold on the open market through ADS's Antwerp, Belgium, office. All of ADMJV's near-gem quality material was processed in India, principally from ADS's Bombay office, prior to being sold. ADMJV, through the Indo-Argyle Diamond Council, assisted its Indian customers to market their diamond jewelry in the United States.[47]

ADM changed the AK-1 treatment plant's screen sizes in October so that lower value diamonds of less than 1.5 millimeters in size would not be recovered. The change was to allow the treatment plant capacity to be increased by about 1 Mt/yr, to 9 Mt/yr. Although the amount of carats actually recovered was to decrease by 15% per year, the annual value of production was expected to increase by 10% because of the increase in the average size of the diamonds recovered.[48]

Australia's only other commercial diamond operation was Poseidon Bow River Diamond Mine Ltd.'s Bow River Mine, 25 km northeast of the Argyle Mine. All of Bow River's output was marketed under a sales agreement with the CSO. About 20% of the Bow River production was gem quality, with a consistent percentage of the intensely pink diamonds, and 80% was industrial grade. Bow River diamonds were recovered from buried diamondiferous gravels that originated from the AK-1 lamproite pipe.

Gemstones.—Australia again was the world's leading producer of precious opal in 1995, accounting for about 90% of the world's production. About one-half of Australia's opal was produced from fields at Andamooka, Coober Pedy, and Mintabie in SA. Most was hand-mined, either from an opencut or an underground drive. Opal in NSW mostly was mined at Lightening Ridge, the world's major source of the highly prized and valuable black opal, although a small amount still was produced at White Cliffs, the site of opal discovery in 1889. A small quantity of opal also was produced in western QLD.

Australia also continued to be the world's leading producer of natural sapphire. Australia's commercial sapphire production was mined from alluvial deposits in the Inverell-Glen Innes (New England) region of northern NSW and the Rubyvale-Anakie region of central QLD. Australia was supplying up to about 70% by volume of the world's sapphire until 1987 when the Thai Government lifted restrictions on mechanized mining of Thailand's sapphire, and production was increased substantially in China and Nigeria. Consequently, Australia's share of world supply gradually has declined so that in 1995 it was producing only about 25% to 30% by volume of the world's rough sapphire output. Most of the uncut gems still were exported to Thailand, the recognized world leader for cutting and marketing.

Australia again continued to produce almost all the world's chrysoprase from the Marlborough, QLD, deposit and has the world's largest known resource of nephrite jade at Cowell, on the Eyre Peninsula in SA. In addition, Australia also produced other gemstones, including agate, amethyst, chiastolite, emerald (aquamarine), garnet, rhodonite, topaz, tourmaline, turquoise, and zircon.

Gypsum.—Dampier Salt Ltd., 64.9% owned by CRA, announced at yearend its plans to begin construction early in 1996 of a gypsum project at its Lake MacLeod salt operations near Carnarvon, WA. Dampier Salt planned to produce gypsum for the wallboard and cement industries of Asia, particularly Japan, with the first shipments expected to begin late in 1997. Initial production capacity was to be 1 Mt/yr. The gypsum deposit, which overlies a salt deposit, was to be dredged from the dry lake bed and pumped as a slurry to a heap-leach pad where salt was to be leached out. The gypsum then was to be trucked to Dampier Salt's storage and port facility at nearby Cape Cuvier.[49]

Lithium and Tantalum.—In 1995, Gwalia supplied about 60% of the world's lithium materials from spodumene ore mined at the Greenbushes Mine, 300 km south of Perth, WA. Gwalia also was the world's largest producer of tantalum concentrates from tantalite ore. Both commodities were extracted from two separate pits, spaced about 300 meters apart, within the Greenbushes pegmatite ore body, one of the largest mineralized, zoned, rare-metal pegmatites in the world.[50] Gwalia also produced tantalum from its Mount Cassiterite Mine, 100 km south of Port Hedland in WA.

Production in 1995 of lithium minerals by Gwalia, Australia's sole producer, increased almost 80% over that of the previous year. This was achieved by doubling the capacity of the lithium minerals plant to 150,000 t/yr through the addition of another ball mill to increase milling capacity and the change to a 24-hour, 3-shift operation.

To add value to its mineral products through downstream processing, Gwalia completed the construction and began commissioning in September its 5,000-t/yr, $13-million lithium carbonate plant. Lithium carbonate is a key product in the lithium chemicals industry, an industry many times larger than the lithium minerals industry that Gwalia has dominated. This plant enabled Gwalia to become an integrated producer of a range of lithium-based chemical products.

About 6,000 t of spodumene and 20,000 t of tantalite were mined from the open pits and trucked weekly to run-of-mine storage pads, where the material was separately stockpiled according to grade and mineralogical characteristics before crushing and subsequent processing. Unlike many mining-site operations, Gwalia used a single hard-rock crushing plant to process both the spodumene and tantalite ores by changing the production program once or twice each week to accommodate each ore in its own 3-stage crushing circuit.[51]

Magnesia.—The 60-40 joint-venture between Queensland Metals Corp. and Pancontinental Resources (Kunwarara) Pty. Ltd. continued to mine low-iron magnesite at its Queensland Magnesia Project (QMAG) at Kunwarara, about 60 km northwest of Rockhampton, QLD, during the year. Queensland Magnesia (Operations) Pty. Ltd., a wholly owned subsidiary of Pancontinental Resources, was the mine operator. The ore, cryptocrystalline magnesite, was mined using mechanical and hydraulic techniques, beneficiated, and transported to the plant at Parkhurst on the outskirts of Rockhampton for the production of electrofused and dead-burned magnesia.

The QMAG partners were considering near yearend to increase production from 24,000 t/yr of electrofused magnesia and 90,000 t/yr of dead-burned magnesia to 29,000 t/yr and 135,000 t/yr, respectively, within the next 3 years. Capacity of the plant has not changed since its original construction in 1991.[52]

Salt.—Dampier Salt continued to supply more than one-half of Australia's annual salt production from its solar operations at Dampier Field, on Mistaken Island near Dampier in the Pilbara area, and Lake MacLeod Field, near Carnarvon, both in WA. The Dampier Field had twice the annual production capacity, about 3 Mt, as that of the Lake MacLeod Field.

Dampier Salt also supplied more than one-half of Australia's salt exports, 70% of which went to Japan. Indonesia, the Republic of Korea, and Taiwan received the bulk of the remaining exports.

Mineral Fuels

Coal.—Australia remained the world's fifth largest producer of coal (all grades) in the world in 1995. NSW and QLD together accounted for more than 95% of the country's coal production and virtually all of its exports. Coal exports were shipped from nine terminals at seven ports along the eastern coast of the country.

The principal areas of coal production were from the Bowen Basin, QLD; Hunter Valley, Western Coalfield, and South Coast Coalfield, NSW; Leigh Creek, SA; Fingal, TAS; Latrobe Valley Coalfield, VIC; and near Bunbury, WA. The NT had no coal production during the year.

Australia retained in 1995 its position as the world's largest exporter of coal, a position it has held since 1984, shipping more than 136.7 Mt, an increase of more than 4% over the previous record high of more than 131 Mt set in 1993. Australia controlled an estimated 35% to 40% of the world's seaborne coal trade by exporting 70% of its salable coal production. Australian coal was exported to more than 30 countries around the world. The major markets were Japan and other Asian countries, which accounted for about 80% of Australia's exports in 1995. Significant amounts of coal also were exported to Europe, India, the Middle East, North Africa, and South America.[53]

The coal industry also remained in 1995 Australia's largest foreign-exchange earner, accounting for an estimated one-quarter of export revenues from the minerals sector and about 15% of the country's export earnings.

Portman Mining's Burton Coal Project, 120 km southwest of Mackay in QLD's Bowen Basin, progressed significantly during the year. The project was scheduled to be commissioned in October 1996, with the full design capability of about 2 Mt/yr expected to be reached during 1997. The exploration permit for the Burton coal deposit, approximately 20 km east of the operating Goonyella, North Goonyella, and Riverside coal mines, was acquired by Portman Mining in 1993. Portman Mining completed a feasibility study early in 1995 that confirmed the project's commercial viability. Thiess Construction Pty. Ltd. purchased a 5% interest in the project, and the remaining 95% was transferred to Portman Mining's wholly owned subsidiary Pelsoil NL. Thiess Construction and Pelsoil entered in December into their own joint-venture agreement to own, develop, and operate the Burton Coal Project; Burton Coal Pty. Ltd., another wholly owned subsidiary of Portman Mining, was to be the mine operator.[54]

Petroleum and Natural Gas.—The merger of Caltex Australia Ltd., 75% owned by Texaco Inc. of the United States, and Ampol Ltd. was approved in May by company shareholders following sanctioning by the Trade Practices Commission (TPC), creating for the first time a leading majority Australian-owned refining and marketing company. The new company, Australian Petroleum Co. Pty. Ltd., was to become the country's largest downstream petroleum company. The Caltex brand name was to disappear; and a newly designed Ampol brand was to be used on all joint facilities, vehicles, and equipment. The TPC authorization stipulated the sale to independent operators of redundant bulk terminals and service stations, guaranteeing a supply of fuel for these retail outlets.[55] The merged company would draw petroleum products from the two refineries previously owned separately, the Kurnell Refinery in NSW and the Lytton Refinery in QLD.

Woodside Petroleum Pty. Ltd., operator of the massive North West Shelf Gas (NWS Gas) project on the Continental Shelf about 140 km offshore of Dampier, WA, successfully began production in February of natural gas and condensate from the first of 12 planned production wells at the Goodwyn A offshore drilling and production platform following a delay of 16 months. Damage caused during the driving in 1992 of piles to support the platform's substructure has cost the partners in the NWS Gas joint venture about $240 million before insurance reimbursements in remedial engineering and repair work. An accelerated drilling program was to enable production to build up to the full capacity of 25.5 million cubic meters per day of gas and 80,000 barrels per day of condensate by mid-1996.[56]

The NWS Gas project dispatched in September its 500th cargo of liquefied natural gas (LNG) aboard the vessel *Northwest Swallow*. The 57,000-t cargo was delivered to the Orita terminal of Japan's Kyushu Electric Power Co. Shipments of LNG to Japan, all from the Withnell Bay terminal on Burrup Peninsula in WA, began in July 1989.[57]

WMC was to proceed with a $90-million power generation project using natural gas to be provided from the Goldfields Gas Transmission Joint Venture (GGTJV) pipeline. WMC held a 62.664% interest in the GGTJV and was committed to the construction of several spur lines to link its nickel mines and associated facilities at Kambalda, Leinster, and Mount Keith, along with its nickel smelter at Kalgoorlie, with the main gas pipeline originating from the offshore NWS Gas fields. The project was to include installation of 40-MW gas turbines at each of the four WMC operations. Work was expected to be completed simultaneously with the startup of gas transmission in August or September 1996. Other partners in GGTJV were Normandy Poseidon Ltd., 25.493%, and BHP Minerals, 11.843%. Australia's largest gas pipeline operator, AGL Pipelines, would be the pipeline operator of the 1,480-km, $365-million "Gas to the Goldfields" pipeline.[58]

The total number of petroleum exploration and development wells drilled during 1995 (212) was 40 more than the revised number drilled during 1994 (172). The number of onshore exploration wells drilled in 1995 (92) was 10 more than that in 1994 (82). The number of offshore exploration wells drilled increased during 1995 to 56 wells compared to the previous year when 46 wells were drilled. The total number of exploration wells drilled in 1995 (148) increased almost 16% from the number drilled in 1994 (128). The total number of development wells drilled (64) was 20 more than that in 1994 (44), with 30 wells drilled onshore and 34 drilled offshore, compared to 19 (revised) and 25 wells, respectively, drilled in 1994. The total meters drilled for exploration and development wells in 1995 (475,360) was about 14% more than that drilled in 1994 (415,451, revised). In seismic survey activity during 1995, the total number of line kilometers recorded (158,351) was marginally less than the number (161,352) recorded in 1994.[59]

Uranium.—Uranium ore in Australia has been known since the 1890's. Uranium ores were mined during the 1930's for the recovery of minute amounts of radium for medical purposes at Radium Hill and Mount Painter, SA; as a result, a few hundred kilograms of uranium also was produced and used as a bright yellow pigment in glass and ceramics. Uranium ores as such were mined and treated in Australia beginning in the 1950's and mainly were intended for export to the United Kingdom and the United States for use in weapons programs of the era.[60]

The Commonwealth Government continued its policy of restricting uranium production to three sites. The two mines involved were the operational Olympic Dam Mine in SA and the Ranger Mine in the Alligator Rivers region of the NT. A third permissible site, Queensland Mines Ltd.'s Nabarlek Mine, also in the Alligator Rivers region of the NT, was closed in 1988 when reserves were depleted. Processing and exporting of its stockpiled ore was completed in 1990. Thus, the "three mines" policy was in fact a "two mines" policy because the export permit holders, Energy Resources of Australia Ltd. (ERA) and WMC, were the only ones with viable mines. The Commonwealth Government had de facto control over uranium mining in that it controlled the licenses to export uranium-bearing ores and prohibited further downstream involvement in the nuclear fuel cycle, including enrichment or other value-added processes.

ERA completed mining at its No. 1 pit at the Ranger site on schedule in December 1994 and began preproduction planning for mining the No. 3 pit, about 1.5 km to the north. Ore stockpiled from pit No. 1 was to be milled through 1999, with the transition to milling ore mined from pit No. 3 beginning in 1997. Prestripping of pit No. 3 was scheduled to start about midyear 1996.[61]

ERA was planning a $15-million mill expansion, including upgrading the level of automation to improve efficiency, giving a 50% increase in capacity by mid-1997; ERA also intended to resume year-round milling in 1996.[62]

Reserves

Australia has a significant resource base of a diverse range of minerals. It is self-sufficient in most minerals of economic importance. However, in spite of extensive exploration, the country still appears to be deficient (import reliant) in chromite, mercury, mica, platinum group metals, and sulfur. Major minerals with known reserves adequate for domestic demand and exports included bauxite, clays, coal, copper, diamond, gold, iron ore, lead, manganese, mineral sands, natural gas, nickel, salt, silver, tin, uranium, and zinc. *(See table 3.)*

Infrastructure

The communications and transportation infrastructure of Australia was well developed. There were 837,872 km of roads, including 243,750 km paved; 228,396 km gravel, crushed stone, or stabilized-soil surface; and 365,726 km unimproved earth. Inland waterways, of which there were about 8,368 km usable for mainly small, shallow-draft craft, were of little importance to the transportation industry.

The Government-owned railway system consisted of 40,478 km of track, of which 16,201 km was standard gauge. There were 1,130 km of electrified rail. A few hundred kilometers of rail was privately owned, most of which served the iron ore industry in WA. There were

308 principal airports with permanent-surface runways out of an aggregate of 480 in the country. International shipping ports included Adelaide, Brisbane, Cairns, Darwin, Devonport, Fremantle, Geelong, Hobart, Launceston, Mackay, Melbourne, Sydney, and Townsville. The merchant marine fleet included 18 petroleum, oils, and lubricant tankers; 3 chemical tankers; 6 liquefied gas tankers; 2 combination ore-oil tankers; and 30 bulk ore freighters.

Pipelines included 5,600 km for natural gas, 2,500 km for crude oil, and 500 km for refined oil products. Electric generating capacity in 1993 was 34.5 gigawatts.[63]

In remote areas where mines, mills, and smelters are usually located, an individual mining company must provide its own infrastructure, such as housing, roads, railways, port facilities, electric power and water facilities, and various community services, including schools, shopping centers, and recreation facilities.

Outlook

Because of a growing worldwide need for mineral and energy supplies, with particular demand for those mineral commodities in which Australia is abundantly endowed and for which Australia is among the world leaders in world supply—bauxite for aluminum production, coal, copper, diamond, gold, iron ore, lead, manganese, mineral sands, natural gas, and zinc—Australia should continue to be a significant world mineral supplier well into the 21st century.

However, a growing awareness of the importance of environmental protection and conservation by Australians has led to higher production costs as the Australian mining industry employs and continues to develop costly techniques for rehabilitation of mined lands and preservation of clean air and water. Since Australia became a major world producer for a number of minerals in the mid-1960's, mining has been in the more remote areas of the country, involving lands that would otherwise have been little utilized; however, this may not always be the case, and the minerals industry probably should remain vigilant toward the environment.

Access to land also has become an important issue to the Australian minerals industry. Entry to lands for exploration either already has been prohibited or has been made difficult over about 30% of the country's land mass owing to restrictions in certain areas, such as national parks and Aboriginal reserves. The percentage of lands made difficult to access is estimated to increase as land claims continue under the NTA of 1993.

Restricted access for exploration because of environmental reasons, land rights issues, or any other reason may result in decreased expend[illegible]n exploration and capital investment. This eve[illegible]y have a very significant effect on the development of large greenfields projects that would be needed to maintain the impetus of the mining and processing sectors.

New investment in the minerals industry was tending toward value added, rather than the primary producing operations of the recent past, and these likely would become more vigorous in the near future.

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TABLE 1
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
METALS						
Aluminum:						
Bauxite, gross weight	thousand tons	40,510	39,746	41,320	41,733	42,655
Alumina	do.	11,703	11,783	12,598	12,892	13,147
Metal, refined:						
Primary	do.	1,228	1,245	1,381	1,317	1,297 2/
Secondary		29,600	40,000	34,800 r/	55,000 r/	55,000
Antimony, Sb content of ores and concentrates e/		1,500	1,701 2/	1,700	1,700	1,700
Bismuth, mine output, Bi content e/		400	--	--	--	--
Cadmium:						
Mine output, Cd content		2,500	2,516	2,375	2,275	2,105 2/
Metal, smelter (refined)		1,076	1,001	951	910	842 2/
Cobalt: e/						
Mine output, analytic content of:						
Nickel ore		1,100	700	500	250	180
Nickel concentrate		500	500	750	950	1,250
Zinc concentrate		70	70	70	70	100
Total		1,670	1,270	1,320	1,270	1,530
Recovered cobalt, including that from imported source material e/		1,400	1,600	1,800 r/	2,200 r/	2,500
Columbium-tantalum concentrate, gross weight		703	656	495	700	900 2/
Copper:						
Mine output, Cu content	thousand tons	320	371	360	391	437 2/
Metal:						
Smelter:						
Primary	do.	195	304	323	315	327 2/
Secondary e/		10,000	10,000	10,000	10,000	10,000
Refined:						
Primary	thousand tons	244	271	285	312	310 2/
Secondary e/		35,000	32,000	24,000	24,000	26,700
Gold:						
Mine output, Au content	kilograms	234,218	243,400 e/	247,196	256,188	253,504 2/
Metal:						
Refined:						
Primary	do.	250,000 e/	250,000 e/	283,726	302,612	289,004 2/
Secondary e/	do.	20,000	8,000	8,345 2/	8,500	8,747 2/
Iron and steel:						
Iron ore:						
Gross weight	thousand tons	117,134	112,101	120,534	128,493	142,936 2/
Fe content	do.	68,732	69,761	74,767	80,900 e/	88,653 2/
Metal:						
Pig iron	do.	5,633 r/	6,384 r/	7,414 r/	7,466	7,475 2/
Ferroalloys: e/						
Ferromanganese		45,000	55,000	75,000	100,000	100,000
Ferrosilicon		19,000	17,000	--	--	--
Silicomanganese		74,000	75,000	75,000	100,000	110,000
Total		138,000	147,000	150,000	200,000	210,000
Steel, crude	thousand tons	6,141 r/	6,803 r/	7,853 r/	8,424 r/	8,493 2/
Semimanufactures e/		3,000	3,000	1,788 2/	4,000	4,000

See footnotes at end of table.

TABLE 1--Continued
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
METALS--Continued						
Lead:						
Mine output, Pb content	thousand tons	579	577 r/	519 r/	537	455 2/
Metal:						
Primary:						
Bullion, for export	do.	172	231	224	197	158 2/
Refined	do.	220	215	221	212	215 2/
Total	do.	392	446	445	409	373 2/
Secondary excluding remelt	do.	19	17	22	17	
Manganese ore (metallurgical):						
Gross weight	do.	1,412 r/	1,251 r/	2,092	1,924 r/	2,176 2/
Mn content e/	do.	664 r/	596 r/	1,043	944 r/	1,066 2/
Nickel:						
Mine output, Ni content	do.	69	58	65	79	101 2/
Metal, smelter (refined Ni and Ni content of oxide)	do.	50	57 r/	55 r/	67 r/	82 2/
Platinum-group metals: e/						
Palladium, Pd content	kilograms	400	400	400	400	400
Platinum, Pt content	do.	100	100	100	100	100
Total	do.	500	500	500	500	500
Rare-earth metals, monazite concentrate: e/						
Gross weight		7,000	6,000	3,000 r/	--	--
Monazite content		3,850	3,300	1,650 r/	--	--
Silver:						
Mine output, Ag content		1,180	1,218	1,092	1,045	920 2/
Metal, refined		400 e/	400 e/	345	362	346 2/
Tin:						
Mine output, Sn content 3/		5,700	6,609	8,057	7,100	8,175 2/
Metal, refined:						
Primary		268	240	222	315	570 2/
Secondary e/		300	360	250	260	300
Titanium concentrates, gross weight:						
Ilmenite	thousand tons	1,363	1,786	1,804	1,782	1,979 2/
Leucoxene		18,000	20,000	21,000	35,000	31,000 2/
Rutile		201,000	183,000 r/	186,000	233,000	200,000 2/
Tungsten, mine output, W content		237	159	23	11	10 2/
Zinc:						
Mine output, Zn content	thousand tons	1,024	1,025	1,010	995	930 2/
Metal, smelter:						
Primary	do.	322	328 r/	316	323	332 2/
Secondary e/		4,500	4,500	4,500	4,975 2/	4,500
Zirconium concentrates, gross weight	thousand tons	292	355	414	502	510 2/
INDUSTRIAL MINERALS						
Abrasives, natural: e/						
Beach pebble		2,000	2,000	2,000	2,000	2,000
Garnet		25,000	25,000	25,000	25,000	25,000
Barite e/		11,000	11,000	11,000	11,000	11,000
Cement, hydraulic	thousand tons	6,108	5,412	5,500 e/	6,500 r/	6,500
Clays: e/						
Bentonite and bentonitic clay		35,000	35,000	35,000	35,000	35,000
Brick clay and shale	thousand tons	8,000	8,000	8,000	8,000	8,000
Cement clay and shale	do.	500	500	500	500	500
Damourite clay		100	100	100	100	100
Fire clay		25,000	25,000	25,000	25,000	25,000
Fuller's earth (attapulgite)		15,000	15,000	15,000	15,000	15,000
Kaolin and ball clay		190,000	180,000	180,000	200,000 r/	210,000
Other	thousand tons	1,000	1,000	1,000	1,000	1,000
Diamond:						
Gem	thousand carats	17,978	18,078	18,844	19,485 r/	18,312 2/
Industrial	do.	17,978	22,095	23,032	23,815 r/	22,381 2/
Total	do.	35,956	40,173	41,876	43,300 r/	40,693 2/
Diatomite e/		11,000	11,000	11,000	11,000	11,000
Feldspar including nepheline syenite e/		16,000	15,000	15,000	16,000	16,000

See footnotes at end of table.

TABLE 1--Continued
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
INDUSTRIAL MINERALS--Continued						
Gemstones, other than diamond: e/						
Opal	value, thousands	$85,000	$85,000	$90,000	$100,000	$100,000
Sapphire	do.	$40,000	$40,000	$40,000	$50,000	$50,000
Other	do.	$900	$900	$1,000	$1,500	$1,500
Total	do.	$125,900	$125,900	$131,000	$151,500	$151,500
Gypsum e/	thousand tons	2,000	2,000	2,000	2,000	2,000
Kyanite e/		800	800	800	800	800
Lime e/		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Magnesite e/		100,000	262,000	260,600	285,610 2/	280,400
Nitrogen, N content of ammonia		414,100	391,900	398,000	412,600 r/	432,900 2/
Perlite, crude e/		5,000	5,000	5,000	5,000	5,000
Phosphate rock e/		2,400 r/	1,500 r/	1,700 r/	1,500 r/	1,500
Salt	thousand tons	7,791	7,693	7,737 r/	7,685 2/	8,480 2/
Sillimanite e/ 4/		100	100	100	100	100
Spodumene, concentrate		40,736	42,516	40,000 e/	45,987 r/	81,841 2/
Stone, sand and gravel: e/						
Construction sand	thousand tons	30,000	30,000	30,000	30,000	30,000
Gravel	do.	15,000	15,000	15,000	15,000	15,000
Dolomite	do.	1,000	10,000	10,000	10,000	10,000
Limestone:						
For cement	do.	6,000	6,000	6,000	6,000	6,000
For other uses	do.	6,000	6,000	6,000	6,000	6,000
Silica in the form of quartz, quartzite, glass sand	do.	2,000	2,000	2,000	2,500	2,500
Other:						
Crushed and broken stone	do.	65,000	65,000	65,000	65,000	65,000
Dimension stone	do.	100	100	100	100	100
Unspecified	do.	30,000	30,000	30,000	30,000	30,000
Sulfur, byproduct:						
Metallurgy	do.	223	295	299	275	275
Petroleum	do.	75	75	85	115	125
Total	do.	298	370	384	390	400
Talc, chlorite, pyrophyllite, steatite e/		216,000	215,000	215,000	215,000	215,000
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Bituminous and subbituminous	thousand tons	206,045	223,602	226,330	227,772	239,578 2/
Lignite	do.	52,124	50,228	48,458	48,582	48,115 2/
Total	do.	258,169	273,830	274,788	276,354	287,693 2/
Coke, metallurgical e/	do.	300 r/	300 r/	300 r/	300 r/	322 2/
Fuel briquets e/	do.	750	750	750	750	750
Gas, natural, marketed	million cubic meters	21,687	23,463	24,519	28,146	30,000
Natural gas liquids	thousand 42-gallon barrels	22,261	23,411	23,050 r/	23,342 r/	24,000
Peat e/		11,000	11,000	11,000	11,000	11,000
Petroleum:						
Crude	thousand 42-gallon barrels	198,821	195,316	181,387 r/	196,539	200,000
Refinery products:						
Gasoline:						
Aviation	do.	959	1,076	1,011	955	943
Motor	do.	106,576	108,486	112,408	112,877	113,103
Jet fuel	do.	23,298	24,728	27,225	27,008	24,499
Kerosene	do.	315	688	282	514	491
Distillate fuel oil	do.	68,857	65,894	71,263	72,155	75,484
Residual fuel oil	do.	17,374	15,770	14,890	14,022	15,592
Lubricants	do.	4,226	4,384	4,261	4,903	4,881
Liquefied petroleum gas	do.	5,646	5,862	6,287	7,162	8,082
Bitumen	do.	3,288	3,561	4,252	4,129	3,818
Unspecified	do.	6,760	5,787	6,125	5,976	7,145
Refinery fuel and losses	do.	5,763	6,887	8,946 r/	6,242	8,655
Total	do.	243,062	243,123	256,950 r/	255,943	262,693
Uranium, mine output, U content		3,776	2,335	2,256	2,208 r/	3,712 2/

e/ Estimated. r/ Revised.

1/ Includes data available through Aug. 12, 1996.

2/ Reported figure.

3/ Excludes tin content of copper-tin and tin-tungsten concentrates.

4/ In addition, about 7,000 metric tons of sillimanite clay, also known as kaolinized sillimanite, is produced, containing 40% to 48% aluminum oxide.

TABLE 2
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Alumina	Queensland Alumina Ltd., operator. [Comalco Ltd., 30.3%; Kaiser Aluminum and Chemical Corp. (Australia) Ltd., 28.3%; Alcan Australia Ltd., 21.4%; and Pechiney Australia Pty. Ltd., 20%]	Gladstone Refinery, QLD	3,300
Do.	Nabalco Pty. Ltd., operator. (Swiss Aluminium Australia Ltd., 70%; and Gove Aluminium Ltd., 30%)	Gove Refinery, NT	1,600
Do.	Alcoa of Australia Ltd., operator. Alcoa International Holdings, Co., 60.0%; Western Mining Corp. Ltd., 39.25%; QBE Securities Pty. Ltd., 0.5%; and QBE Nominees Pty. Ltd., 0.25%	Kwinana Refinery, WA	1,700
Do.	do.	Pinjarra Refinery, WA	3,000
Do.	do.	Wagerup Refinery, WA	1,700
Do.	Worsley Alumina Pty. Ltd., operator. [Reynolds Australia Alumina Ltd., 56%; The Shell Co. of Australia Ltd., 31.5%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; and Nissho Iwai Alumina, 2.5%]	Worsley Refinery, WA	1,600
Aluminum	Comalco Aluminium (Bell Bay) Ltd., 100%	Bell Bay Smelter, TAS	120
Do.	Boyne Island Smelters Ltd., operator. (Comalco Ltd., 59.25%; Marubeni Corp., Sumitomo Corp., and Light Metal Industries, 17% collectively; Mitsubishi Corp. and Mitsubishi Materials Corp., 14.25% jointly; and Yoshida Kogyo KK, 9.5%)	Boyne Island Smelter, QLD	260
Do.	Capral Aluminium Ltd., 100%	Kurri Kurri Smelter, NSW	155
Do.	Alcoa of Australia Ltd., operator. Alcoa International Holdings, Co., 60.0%; Western Mining Corp. Ltd., 39.25%; QBE Securities Pty. Ltd., 0.5%; and QBE Nominees Pty. Ltd., 0.25%	Point Henry Smelter, VIC	182
Do.	Alcoa of Australia Ltd., 45% and manager; ALUVIC (State of VIC agency), 25%; First National Resources Trust, 10%; China International Trust Investment Co., 10%; and Marubeni, 10%	Portland Island Smelter, VIC	327
Do.	Tomago Aluminium Co. Pty. Ltd., operator. (Gove Aluminium Finance Ltd., 35%; Pechiney Australia Pty. Ltd., 35%; Australian Mutual Provident Society, 15%; VAW Australia Pty. Ltd., 12%; and Hunter Douglas Ltd., 3%)	Tomago Smelter, NSW	380
Antimony	Hillgrove Gold Ltd., 100%	Garibaldi-Eleanora (Hillgrove) Mine, NSW	3
Bauxite	Nabalco Pty. Ltd., operator. (Swiss Aluminium Australia Ltd., 70%; and Gove Aluminium Ltd., 30%)	Gove Mine, NT	7,000
Do.	Alcoa of Australia Ltd., operator. Alcoa International Holdings, Co., 60.0%; Western Mining Corp. Ltd., 39.25%; QBE Securities Pty. Ltd., 0.5%; and QBE Nominees Pty. Ltd., 0.25%	Huntly, Jarrahdale, and Willowdale Mines, WA	23,500
Do.	Worsley Alumina Pty. Ltd., operator. [Reynolds Australia Alumina Ltd., 56%; The Shell Co. of Australia Ltd., 37.5%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; and Nissho Iwai Alumina, 2.5%]	Mount Saddleback (Worsley) Mine, WA	7,000
Do.	Comalco Aluminium Ltd., 100%	Weipa operations, QLD	11,100
Cement	Blue Circle Southern Cement Ltd., operator. Boral Ltd., 100%	Berrima Plant, NSW	1,200
Do.	Adelaide Brighton Cement Ltd., 49% and operator, and Adelaide Brighten Ltd., 51%	Birkenhead Plant, SA	1,000
Do.	Queensland Cement Ltd., operator. Holderbank (Switzerland), 100%	Darra Plant, QLD	700
Do.	Adelaide Brighton Cement Ltd., 49% and operator, and Adelaide Brighten Ltd., 51%	Geelong Plant, VIC	800
Do.	Goliath Cement Ltd., operator. Australian Cement Holdings Ltd., 100%	Railton Plant, TAS	1,000
Do.	Cockburn Cement Ltd., operator. Rugby Group (United Kingdom), 100%	South Coogee Plant, WA	1,000
Coal, black	Powercoal Pty. Ltd., 100%	Angus Place underground mine, NSW	1,500
Do.	BHP Steel Collieries Division, 100%	Appin underground mine, NSW	2,400
Do.	Powercoal Pty. Ltd., 100%	Awaba State underground mine, NSW	1,000
Do.	Coalex Pty. Ltd., 95% and manager; and Sumitomo Coal Mining Co. Ltd., 5%	Baal Bone underground mine, NSW	3,000

See footnotes at end of table.

TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Coal, black--Continued:	Central Queensland Coal Associates, 100%. (BHP Australia Coal Ltd., 44.72% and operator; QCT Resources, 27.78%; Mitsubishi Development Pty. Ltd., 13.33%; AMP society, 8.61%; and Pancontinental Mining Ltd., 5.56%)	Blackwater opencut, QLD	5,000
Do.	Pacific Coal Pty. Ltd., 57.19%, operator; ARCO Coal Australia Inc., 31.42%; Electric Power Development Co., 7.97%; and Joint Coal Development Co. Ltd., 3.42%	Blair Athol opencut, QLD	8,500
Do.	Clutha Coal Pty. Ltd., 100%	Brimstone No. 1 underground mine, NSW	2,400
Do.	Camberwell Coal Pty. Ltd., operator. (Navidale Pty. Ltd., 50%; Toyota Tsusho Corp., 40%; and Dia Coal Ltd., 10%)	Camberwell opencut, NSW	2,400
Do.	Coalex Pty. Ltd., 80% and manager; Kyodo Oil Aust. Pty. Ltd. (Japan), 10%; and Yukong Ltd. (Republic of Korea), 10%	Clarence underground mine, NSW mine, NSW	1,900
Do.	Powercoal Pty. Ltd., 100%	Cooranbong underground mine, NSW	1,200
Do.	BHP Steel Collieries Division, 100%	Cordeaux underground mine, NSW	2,800
Do.	Curragh Queensland Mining Ltd., operator. [ARCO Coal Australia Inc., 60%; R.W. Miller Ltd., 30%; and Mitsui Coal Development (Australia) Ltd., 10%]	Curragh opencut, QLD	6,600
Do.	The Shell Co. of Australia Ltd., 82%; Showa Denko KK, 3%; and Marubeni Corp., 15%	Dartbrook underground mine, NSW	4,000
Do.	Capricorn Coal Management Pty. Ltd., manager. (The Shell Co. of Australia Ltd., 46.75%; Minproc Energy Pty. Ltd., 26.06%; British Coal Corp., 14.81%; and Ruhrkohle Australia Pty. Ltd., 12.38%)	German Creek opencut and underground mine, QLD	6,000
Do.	Central Queensland Coal Associates, 100%. (BHP Australia Coal Ltd., 44.72% and operator; QCT Resources, 27.78%; Mitsubishi Development Pty. Ltd., 13.33%; AMP society, 8.61%; and Pancontinental Mining Ltd., 5.56%)	Goonyella-Riverside opencuts, QLD	9,250
Do.	Arco Coal Australia Inc., 80% and manager; Mitsui and Co. Ltd., 15%; and MLC Coal Investments Pty. Ltd., 5%	Gordonstone underground mine, QLD	4,200
Do.	Oakbridge Ltd., 100%	Gretley underground mine, NSW	1,300
Do.	Coal and Allied Industries Ltd., 100%	Hunter Valley No. 1 and No. 2 opencuts, NSW	7,500
Do.	Electricity Trust of SA, 100%	Leigh Creek opencut mine, SA	3,000
Do.	Coal and Allied Industries Ltd., 80% and manager; and Pohang Iron and Steel Co. Ltd., 20%	Mount Thorley opencut, NSW	6,500
Do.	Powercoal Pty. Ltd., 100%	Munmorah State underground mine, NSW	1,200
Do.	do.	Myuna underground mine, NSW	1,500
Do.	MIM Holdings Ltd., 75%; and Agip Coal Australia Pty. Ltd., 25%	Newlands opencut, QLD	4,000
Do.	Powercoal Pty. Ltd., 100%	Newstan State underground mine, NSW	2,500
Do.	Central Queensland Coal Associates, 100%. (BHP Australia Coal Ltd., 44.72% and operator; QCT Resources, 27.78%; Mitsubishi Development Pty. Ltd., 13.33%; AMP society, 8.61%; and Pancontinental Mining Ltd., 5.56%)	Norwich Park opencut, QLD	4,500
Do.	do.	Peak Downs opencut, QLD	5,500
Do.	Oakbridge Ltd., 100%	Pelton-Ellalong underground mine, NSW	2,000
Do.	Central Queensland Coal Associates, 100%. (BHP Australia Coal Ltd., 44.72% and operator; QCT Resources, 27.78%; Mitsubishi Development Pty. Ltd., 13.33%; AMP society, 8.61%; and Pancontinental Mining Ltd., 5.56%)	Saraji opencut, QLD	4,700
Do.	Shell Australia Ltd., 100%	South Bulli underground mine, NSW	3,000
Do.	Kembla Coal and Coke Pty. Ltd., 100%	Tahmoor underground mine, NSW	4,100
Do.	FAI Mining Ltd., 70% and manager; Marubeni Coal Pty. Ltd., 14%; Taiheiyo Australia Pty. Ltd., 10%; Chelsea Coal Pty. Ltd., 3%; and Kokan Kogyo (Australia) Pty. Ltd., 3%	Teralba underground mine, NSW	1,700
Do.	BHP Steel Collieries Division, 100%	Tower underground mine, NSW	1,600
Do.	Ulan Coal Mines Ltd., manager. (Mitsubishi Development Pty. Ltd., 49%; Exxon Coal Authorities Australia Ltd., 36%; and the State Superannuation Board of NSW, 15%)	Ulan No. 2 underground and Ulan opencut mines, NSW	5,500
Do.	Wambo Mining Corp. Pty. Ltd., 100%	Wambo underground and opencut mines, NSW	4,000
Do.	Kembla Coal and Coke Pty. Ltd., 100%	West Cliff underground mine, NSW	3,000

See footnotes at end of table.

TABLE 2--Continued

AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Coal, black--Continued:	FAI Mining Ltd., 70% and manager; Marubeni Coal Pty. Ltd., 14%; Taiheiyo Australia Pty. Ltd., 10%; Chelsea Coal Pty. Ltd., 3%; and Kokan Kogyo (Australia) Pty. Ltd., 3%	West Wallsend underground mine, NSW	2,400
Do.	Powercoal Pty. Ltd., 100%	Wyee State underground mine, NSW	1,800
Coal, brown	Generation Victoria (formerly State Electricity Commission of VIC), 100%	Latrobe Valley opencut mines (Loy Yang, Morwell, and Yallourn), VIC	48,000
Copper	Denehurst Ltd., 50% and manager; and Macquarie Resources Ltd., 50%	Benambra Mine, VIC	18
Do.	Poseidon Gold Ltd., manager, 40%; Billiton Australia Gold Pty. Ltd., 30%; Newcrest Mining Ltd., 20%; and Kobe Alumina Associates (Australia) Pty. Ltd., 10%	Boddington Mine, WA	10
Do.	GSM Metals Pty. Ltd., operator. (Golden Shamrock Mines Ltd., 70%; and private interests, 30%)	Cobar (CSA) Mine, NSW	35
Do.	Ernest Henry Mining Pty. Ltd., operator. (MIM Holdings Ltd., 51%; and Savage Resources Ltd., 49%)	Ernest Henry Mine, QLD	95
Do.	Poseidon Gold Ltd., 100%	Gecko Mine, NT	17
Do.	Nord Pacific Ltd., operator. [Straits Engineers Pte. Ltd. (Singapore), 60%; and Nord Pacific Ltd., 40%]	Girilambone Mine, NSW	15
Do.	Murchison Zinc Co. Pty. Ltd., operator. (Normandy Poseidon Ltd., 45%; Esso Australia Resources Ltd., 35%; and Aztec Mining Co. Ltd., 20%)	Golden Grove Project (includes Gossan Hill and Scuddles Mines), WA	4
Do.	Gunpowder Copper Ltd., operator. (Adelaide Brighton Cement Holdings Ltd., 100%)	Gunpowder Mine, QLD	9
Do.	Aberfoyle Ltd., 100%	Hellyer Mine, TAS	4
Do.	Mount Isa Mines Ltd., operator. (MIM Holdings Ltd., 100%)	Hilton Mine at Mount Isa, QLD	180
Do.	Horseshoe Gold Mine Project, manager. (Sabminco NL, 57%; and Asian Pacific Resources Pty. Ltd., 43%)	Horseshoe Mine, WA	15
Do.	Mount Isa Mines Ltd., operator. (MIM Holdings Ltd., 100%)	Mount Isa Smelter, QLD	175
Do.	Gold Mines of Australia Ltd., 100%	Mount Lyell Mine, TAS	39 3/
Do.	Western Mining Corp. Holdings Ltd., 100%	Nifty Mine, WA	16
Do.	North Ltd., operator, 80%; Sumitomo Metal Mining Co. Ltd., 13.3%; and Sumitomo Corp., 6.7%	Northparkes Mine, NSW	65,000
Do.	Olympic Dam Operations Ltd., manager. (Western Mining Corp. Holdings Ltd., 100%)	Olympic Dam Mine, SA	84
Do.	do.	Olympic Dam Refinery, SA	50
Do.	do.	Olympic Dam Smelter, SA	70
Do.	Peak Gold Mines Pty. Ltd., operator. (CRA Ltd., 100%)	Peak Mine, NSW	3
Do.	Southern Copper Ltd., manager. (CRA Ltd., 60%; Furukawa Co. Ltd., 30%; and Nissho-Iwai Corp., 10%)	Port Kembla Refinery, NSW	80
Do.	do.	Port Kembla Smelter, NSW	80
Do.	Red Dome Pty. Ltd., operator. (Niugini Mining Ltd., 100%)	Red Dome Mine, QLD	6
Do.	Pasminco Ltd., 100%	Rosebery Mine, TAS	4
Do.	Australian Resources and Mining Co. NL, 100%	Selwyn (Starra) Mine, QLD	16
Do.	Newcrest Mining Ltd., 100%	Telfer Mine, WA	2
Do.	Pancontinental Mining Ltd., manager, 100%	Thalanga Mine, QLD	9
Do.	Copper Refineries Pty. Ltd., operator. (MIM Holdings Ltd., 100%	Townsville Refinery, QLD	175
Do.	Denehurst Ltd., 100%	Woodlawn Mine, NSW	8
Diamond thousand carats	Argyle Diamond Mines Pty. Ltd., operator and manager. (RTZ Ltd.-CRA Ltd., 56.8%; Ashton Mining Ltd., 38.2%, and Western Australian Diamond Trust, 5%)	Argyle Mine (AK-1 lamproite pipe and alluvial deposits), WA	40,000
Do. do.	Poseidon Bow River Diamond Mine Ltd., 100%.	Bow River Mine, WA	1,000
Gas, condensate thousand 42-gallon barrels per day	Woodside Petroleum Pty. Ltd., manager; BP Developments Australia Ltd.; Chevron Asiatic Oil Co.; Shell Development (Australia) Pty. Ltd.; BHP Petroleum (North West Shelf) Pty. Ltd.; and Japan Australia Oil (MiMi) Pty. Ltd., 16.67% each	North West Shelf Project, 140 kilometers offshore from Dampier, WA	60
Gas, natural million cubic meters per day	do.	North West Shelf Project, 140 kilometers offshore from Dampier, WA	20
Gold kilograms	Poseidon Gold Ltd., 100%	Big Bell Mine, WA	5,500
Do. do.	Poseidon Gold Ltd., manager, 40%; Billiton Australia Gold Pty. Ltd., 30%; Newcrest Mining Ltd., 20%; and Kobe Alumina Associates (Australia) Pty. Ltd., 10%	Boddington Mine, WA	11,000

See footnotes at end of table.

TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995 1/

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Gold--Continued:	kilograms	Poseidon Gold Ltd., operator, 62%; and Forrestania Gold NL, 38%	Bounty Mine, WA	2,500
Do.	do.	Great Central Mines NL, 100%	Bronzewing Mine, WA	6,200
Do.	do.	Territory Goldfields NL, 100%	Cosmo Howley Mine, NT	1,700
Do.	do.	Ernest Henry Mining Pty. Ltd., operator. (MIM Holdings Ltd., 51%; and Savage Resources Ltd., 49%)	Ernest Henry Mine, QLD	3,700
Do.	do.	Perilya Mines NL, 100%	Fortnum Mine, WA	1,500
Do.	do.	Poseidon Gold Ltd., 100%	Golden Crown Mine, WA	1,150
Do.	do.	North Flinders Mines Ltd., 100%	The Granites Mine, NT	4,750
Do.	do.	Golden Valley Joint Venture, manager. (Placer Pacific Ltd., 60%; and Delta Gold NL, 40%)	Granny Smith Mine, WA	4,800
Do.	do.	Alcoa of Australia Ltd., operator. Alcoa International Holdings, Co., 60.0%; Western Mining Corp. Ltd., 39.25%; QBE Securities Pty. Ltd., 0.5%; and QBE Nominees Pty. Ltd., 0.25%	Hedges Mine, WA	4,900
Do.	do.	Hampton Areas Australia Ltd., operator. (Gold Mines of Kalgoorlie Ltd., 100%)	Jubilee Mine, WA	2,300
Do.	do.	Australian Gold Refineries, operator. Gold Corp. of Australia, 100% (State of WA agency)	Kalgoorlie Refinery, WA	46,000
Do.	do.	Delta Gold NL, manager, 50%; and North Ltd., 50%	Kanowna Belle Mine, WA	5,600
Do.	do.	Kidston Gold Mines Ltd., 100%	Kidston Mine, QLD	6,500
Do.	do.	Sons of Gwalia Ltd., 100%	Leonora Mine, WA	2,800
Do.	do.	Plutonic Resources Ltd., 100%	Meekatharra area mines, WA	2,300
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager. (Gold Mines of Kalgoorlie Ltd., 50%; and Homestake Gold of Australia Ltd., 50%)	Mount Charlotte Mine, WA	4,300
Do.	do.	Reynolds Australia Gold Operations Ltd., 100%	Mount Gibson Mine, WA	3,450
Do.	do.	Mount Leyshon Gold Mines Ltd., 100%	Mount Leyshon Mine, QLD	7,500
Do.	do.	Hill 50 Gold Mine NL, operator. (Western Mining Corp. Holdings Ltd., 100%)	Mount Magnet-Hill 50 Mines, WA	6,600
Do.	do.	Centaur Mining and Exploration Ltd., 100%	Mount Pleasant Mine, WA	1,750
Do.	do.	Zapopan NL, 100%	Mount Todd Mine, NT	3,100
Do.	do.	Newcrest Mining Ltd., manager, 80%; and Titan Resources NL, 20%	New Celebration Mine, WA	4,750
Do.	do.	Eagle Mining Corp. NL, 100%	Nimary Mine, WA	3,100
Do.	do.	MIM Holdings Ltd., manager, 50.1%; and Haoma Mining NL, 49.9%	Nolans Mine, QLD	3,400
Do.	do.	North Ltd., operator, 80%; Sumitomo Metal Mining Co. Ltd., 13.3%; and Sumitomo Corp., 6.7%	Northparkes Mine, NSW	2,200
Do.	do.	Olympic Dam Operations Ltd., manager. (Western Mining Corp. Holdings Ltd., 100%)	Olympic Dam Mine, SA	1,500
Do.	do.	Newcrest Mining Ltd., 100%	Ora Banda Mine, WA	2,650
Do.	do.	MIM Holdings Ltd., 100%	Pacific precious metals refinery, NSW	1,900
Do.	do.	Pajingo Gold Mine Pty. Ltd., 100%	Pajingo Mine, QLD	1,900
Do.	do.	Peak Gold Mines Pty. Ltd., operator. (CRA Ltd., 100%)	Peak Mine, NSW	3,700
Do.	do.	Australian Gold Refineries, operator. Gold Corp. of Australia, 100% (State of WA agency)	Perth (Newburn) Refinery, WA	95,000
Do.	do.	Renison Goldfields Consolidated Ltd., 100%	Pine Creek Mine, NT	3,100
Do.	do.	Plutonic Resources Ltd., 100%	Plutonic Mine, WA	5,300
Do.	do.	Red Dome Pty. Ltd., operator. (Niugini Mining Ltd., 100%)	Red Dome Mine, QLD	3,600
Do.	do.	Western Mining Corp. Holdings Ltd., 100%	St. Ives Mines, WA	7,500
Do.	do.	Australian Resources Ltd., 100%	Selwyn (Starra) Mine, QLD	3,600
Do.	do.	Stawell Gold Mines Joint Venture, manager. (MPI Gold Pty. Ltd., 50%; and Pittston Mineral Ventures of Australia, 50%)	Stawell Mine, VIC	1,100
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager. (Gold Mines of Kalgoorlie Ltd., 50%; and Homestake Gold of Australia Ltd., 50%)	Super Pit, WA	23,000
Do.	do.	Zapopan NL, 100%	Tanami Mine, NT	1,900
Do.	do.	do.	Telfer Mine, WA	12,000
Do.	do.	Gold Mines of Australia Ltd., 100%	Temora Mine, NSW	2,250
Do.	do.	Westgold Resources NL, 100%	Tuckabianna Mine, WA	1,700
Do.	do.	Wiluna Mines Ltd., 100%	Wiluna Mine, WA	4,230
Do.	do.	Ross Mining NL, 100%	Wirralie Mine, QLD	3,200

See footnotes at end of table.

TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Gold--Continued: kilograms	Gold Mines of Australia Ltd., 100%	Youanmi Mine, WA	2,350
Ilmenite	Cable Sands (WA) Pty. Ltd., operator. [Nissho Iwai Corp. (Japan), 100%]	Busselton East and Waroona Mines. WA	100
Do.	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Capel Mine, WA	180
Do.	Ticor Resources Pty. Ltd., 50% and manager; and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., 50% (Tiwest Joint Venture)	Cooljarloo Mine, WA	480
Do.	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Eneabba West Mine, WA	600
Do.	Mineral Deposits Ltd., operator. (BHP Minerals Ltd., 100%)	Hawks Nest (Stockton, Viney Creek, and Viney Creek North) Mines, NSW	10
Do.	Consolidated Rutile Ltd., 100%	North Stradbroke Island (Bayside and Gordon) Mines, QLD	850
Do.	Westralian Sands Ltd., 100%	Yoganup Extended and Yoganup North Mines, WA	300
Iron ore	Hamersley Iron Pty. Ltd., 100%	Brockman No. 2 Mine, WA	4,500
Do.	Channar Management Services, manager. [Hamersley Iron Pty. Ltd., 60%; and CMIEC (Channar) Pty. Ltd., 40%, a People's Republic of China state-owned enterprise]	Channar Mine, WA	5,500
Do.	Portman Mining Ltd., 60% and operator; and Angang Australia Pty. Ltd., 40%, a People's Republic of China state-owned enterprise	Koolyanobbing Mine, WA	3,000
Do.	Hamersley Iron Pty. Ltd., 100%	Marandoo Mine, WA	10,000
Do.	do.	Mount Tom Price Mine, WA	28,000
Do.	BHP Iron Ore Ltd., 55% and manager; Pilbara Iron Pty. Ltd., 30%; Mitsui-Itochu Pty. Ltd., 10%; and CI Minerals Australia Pty. Ltd., 5%	Mount Whaleback Mine, WA	35,000
Do.	BHP Iron Ore Ltd., 55% and manager; BHP Australia Coal Pty. Ltd., 30%; CI Minerals Australia Pty. Ltd., 8%; and Mitsui Iron Ore Corp. Pty. Ltd., 7%	Nimingarra-Shay Gap-Sunrise Hill and Yarrie Mines (Mount Goldsworthy extension project, WA)	6,500
Do.	Robe River Mining Co. Pty. Ltd., manager of Robe River Iron Associates Joint Venture. (North Mining Ltd., 65%; Mitsui Iron Ore Development Pty. Ltd., 20%; Pannawonica Iron Associates, 10%; and Cape Lambert Iron Associates, 5%	Pannawonica-Deepdale (Robe River) Mine, WA	27,000
Do.	Hamersley Iron Pty. Ltd., 100%	Paraburdoo Mine, WA	15,000
Do.	Savage River Mines, operator. (Pickands Mather and Co. International, 100%)	Savage River Mine, TAS	1,500
Do.	BHP Iron Ore Ltd., 85%; CI Minerals Australia Pty. Ltd., 8%; and Mitsui Iron Ore Corp. Pty. Ltd., 7%	Yandi Mine, WA	15,000
Lead	Pasminco Ltd., 100%	Broken Hill (South) Mine, NSW	150
Do.	Western Metals NL, 80% and manager; and Padaeng Industry Co. Ltd. (Thailand), 20%	Cadjebut Mine, WA	22
Do.	Century Zinc Ltd., operator. (CRA Ltd., 100%)	Century Mine, QLD 4/	40
Do.	GSM Metals Pty. Ltd., operator. (Golden Shamrock Mines Ltd. 100%)	Cobar (CSA) Mine, NSW	4
Do.	Pasminco Ltd., 100%	Cockle Creek Smelter, NSW	30
Do.	Pasminco Ltd., 60%; and Korea Zinc Co. Ltd., 40%	Elura Mine, NSW	15
Do.	Aberfoyle Ltd., 100%	Hellyer Mine, TAS	45
Do.	McArthur River Mining Pty. Ltd., operator. (MIM Holdings Ltd., 70%; and ANT Minerals Pty. Ltd. holding the combined Japanese interests of Nippon Mining and Metals Co. Ltd., 15%; 15%; Mitsubishi Materials Corp., 5%; Mitsui & Co. Ltd., 5%; and Marubeni Corp., 5%)	McArthur River Mine, NT	45
Do.	Mount Isa Mines Ltd., manager. (MIM Holdings Ltd., 100%)	Mount Isa Mine, QLD	190
Do.	do.	Mount Isa Smelter, QLD	240
Do.	Peak Gold Mines Pty. Ltd., manager. (CRA Ltd., 100%)	Peak Mine, NSW	4
Do.	Pasminco Ltd., 100%	Port Pirie Refinery-Smelter, SA	220
Do.	do.	Rosebery Mine, TAS	15
Do.	Pancontinental Mining Ltd., manager, 100%	Thalanga Mine, QLD	15
Do.	Aztec Mining Co. Ltd., 100%	Woodcutters Mine, NT	10
Do.	Denehurst Ltd., 100%	Woodlawn Mine, NSW	14

See footnotes at end of table.

TABLE 2--Continued

AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Leucoxene	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Capel Mine, WA	3
Do.	Ticor Resources Pty. Ltd., 50% and manager; and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., 50% (Tiwest Joint Venture)	Cooljarloo Mine, WA	10
Do.	Westralian Sands Ltd., 100%	Yoganup Extended and Yoganup North Mines, WA	5
Magnesia	Queensland Magnesia (Operations) Pty. Ltd., operator. Queensland Metals Corp., 60%, and Pancontinental Resources, (Kunwarara) Pty. Ltd., 40%	Queensland Magnesia Project, Kunwarara, 60 kilometers northwest of Rockhampton, QLD.	114 5/
Manganese	Groote Eylandt Mining Co. Pty. Ltd., operator. (BHP Minerals Ltd., 100%)	Groote Eylandt Mine, NT	2,300
Do.	Portman Mining Ltd., 100% and manager	Woodie Woodie Mine, WA	400
Manganese alloys	Tasmanian Electro Metallurgical Co. Pty. Ltd., 100%	Bell Bay Smelter, TAS	260
Monazite	RZM Pty. Ltd., operator. [Nissho Iwai Corp. (Japan), 100%]	Tomago Mines, NSW	1
Do.	Westralian Sands Ltd., 100%	Yoganup Extended and Yoganup North Mines, WA	2
Nickel	Outokumpu Mining Australia Pty. Ltd. and Outokumpu Western Australia Pty. Ltd., 50% each and both wholly owned subsidiaries of Outokumpu Oy of Finland	Forrestania area mines, 375 kilometers southeast of Perth, WA	9
Do.	Western Mining Corp. Holdings Ltd., 100%	Kalgoorlie Smelter, WA	80
Do.	do.	Kambalda Nickel Operations (KNO), WA	35
Do.	do.	Kwinana Refinery, WA	46
Do.	do.	Leinster-Mount Keith Nickel Operations (LMKNO), WA, (administratively combined from the previously separate Leinster Nickel Operation and the Mount Keith Nickel Mine)	72
Do.	QNI Ltd., 100%	Yabulu Refinery, QLD	28
Do.	Dominion Mining Ltd., 100%	Yakabindie Mine, WA	24
Opal	Many small producers	Andamooka and Coober Pedy areas, SA; Lightning Ridge area, NSW	NA
Petroleum thousand 42-gallon barrels per day	Petroleum Refineries (Australia) Pty. Ltd., manager. (Mobile Refining Australia Pty. Ltd., 100%)	Altona Refinery, VIC	108
Do. do.	BP Refinery (Bulwer Island) Pty. Ltd., 100%	Bulwer Island Refinery, QLD	57
Do. do.	Shell Refining (Australia) Pty. Ltd., 100%	Clyde Refinery, NSW	80
Do. do.	do.	Geelong Refinery, VIC	110
Do. do.	Australia Petroleum Co. Pty. Ltd., 100%	Kurnell Refinery, NSW	110
Do. do.	BP Refinery (Kwinana) Pty. Ltd., 100%	Kwinana Refinery, WA	120
Do. do.	Australia Petroleum Co. Pty. Ltd., 100%	Lytton Refinery, QLD	85
Do. do.	Petroleum Refineries (Australia) Pty. Ltd., manager. (Mobile Refining Australia Pty. Ltd., 100%)	Port Stanvac Refinery, SA	72
Rutile	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Capel Mine, WA	40
Do.	Ticor Resources Pty. Ltd., 50% and manager; and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., 50% (Tiwest Joint Venture)	Cooljarloo Mine, WA	35
Do.	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Eneabba West Mine, WA	120
Do.	Mineral Deposits Ltd., operator. (BHP Minerals Ltd., 100%)	Hawks Nest (Stockton, Viney Creek, and Viney Creek North) Mines, NSW	35
Do.	Consolidated Rutile Ltd., 100%	North Stradbroke Island (Bayside and Gordon) Mines, QLD	80
Do.	RZM Pty. Ltd., operator. [Nissho Iwai Corp. (Japan), 100%]	Tomago Mines, NSW	35
Do.	Westralian Sands Ltd., 100%	Yoganup Extended and Yoganup North Mines, WA	115
Salt	Dampier Salt Ltd., operator. CRA Ltd., 64.9%; the Japanese companies Itochu Corp., Marubeni Corp., and Nissho-Iwai Corp., held the remaining 35.1%	Dampier and Lake Macleod salt fields, WA	4,500
Do.	Leslie Salt Division, Cargill Australia Ltd., 100%	Leslie Salt operations, WA	2,750

See footnotes at end of table.

TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995 1/

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Silver	kilograms	McArthur River Mining Pty. Ltd., operator. (MIM Holdings Ltd., 70%; and ANT Minerals Pty. Ltd. holding the combined Japanese interests of Nippon Mining and Metals Co. Ltd., 15%; 15%; Mitsubishi Materials Corp., 5%; Mitsui & Co. Ltd., 5%; and Marubeni Corp., 5%)	McArthur River Mine, NT	50,000
Do.	do.	Olympic Dam Operations Ltd., manager. (Western Mining Corp. Holdings Ltd., 100%)	Olympic Dam Mine, SA	12,900
Spodumene		Gwalia Consolidated. Ltd., 100%	Greenbushes Mine, WA	84
Steel		BHP Steel Ltd., 100%	Newcastle steelworks, NSW	1,800
Do.		do.	Port Kembla steelworks, NSW	4,000
Do.		do.	Sydney (Rooty Hill) minimill, NSW	250
Do.		do.	Whyalla steelworks, SA	1,200
Talc		Three Springs Talc Pty. Ltd., 100%	Three Springs Mines, WA	200
Tin		Spectrum Resources Australia Pty. Ltd., 98% and manager; and Nargun Pty. Ltd., 2%	Anchor (Blue Tier) Mine, TAS	3
Do.		Gwalia Consolidated Ltd., 100%	Greenbushes Mine, WA	1
Do.		do.	Greenbushes Smelter, WA	1
Do.		Renison Goldfields Consolidated Ltd., 100%	Renison Bell Mine, TAS	6
Uranium	metric tons uranium oxide	Olympic Dam Operations Ltd., manager. (Western Mining Corp. Holdings Ltd., 100%)	Olympic Dam Mine, SA	1,500
Do.	do.	Energy Resources of Australia Ltd., 100%	Ranger Mine, NT	4,500
Zinc		Pasminco Ltd., 100%	Beltana Mine, SA	30
Do.		do.	Broken Hill (South) Mine, NSW	210
Do.		Western Metals NL, 80% and manager; and Padaeng Industry Co. Ltd. (Thailand), 20%	Cadjebut Mine, WA	65
Do.		Century Zinc Ltd., operator. (CRA Ltd., 100%)	Century Mine, QLD 4/	450
Do.		Pasminco Ltd., 100%	Cockle Creek Refinery-Smelter, NSW	80
Do.		Pasminco Ltd., 60%; and Korea Zinc Co. Ltd., 40%	Elura Mine, NSW	90
Do.		Murchison Zinc Co. Pty. Ltd., manager. (Normandy Poseidon Ltd., 45%; Esso Australia Resources Ltd., 35%; and Aztec Mining Co. Ltd., 20%)	Golden Grove Project (includes Gossan Hill and Scuddles Mines), WA	95
Do.		Aberfoyle Ltd., 100%	Hellyer Mine, TAS	115
Do.		McArthur River Mining Pty. Ltd., operator. (MIM Holdings Ltd., 70%; and ANT Minerals Pty. Ltd. holding the combined Japanese interests of Nippon Mining and Metals Co. Ltd., 15%; Mitsubishi Materials Corp., 5%; Mitsui & Co. Ltd., 5%; and Marubeni Corp., 5%)	McArthur River Mine, NT	160
Do.		Mount Isa Mines Ltd., manager. (MIM Holdings Ltd., 100%)	Mount Isa Mine, QLD	250
Do.		Pasminco Ltd., 100%	Port Pirie Refinery-Smelter, SA	45
Do.		do.	Ridson Refinery, TAS	220
Do.		do.	Rosebery Mine, TAS	45
Do.		Pancontinental Mining Ltd., manager, 100%	Thalanga Mine, QLD	45
Do.		Aztec Mining Co. Ltd., 100%	Woodcutters Mine, NT	45
Do.		Denehurst Ltd., 100%	Woodlawn Mine, NSW	55
Zircon		RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Capel Mine, WA	68
Do.		Ticor Resources Pty. Ltd., 50% and manager; and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., 50% (Tiwest Joint Venture)	Cooljarloo Mine, WA	67
Do.		RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Eneabba West Mine, WA	300
Do.		Mineral Deposits Ltd., operator. (BHP Minerals Ltd., 100%)	Hawks Nest (Stockton, Viney Creek, and Viney Creek North) Mines, NSW	25
Do.		Consolidated Rutile Ltd., 100%	North Stradbroke Island (Bayside and Gordon) Mines, QLD	65
Do.		RZM Pty. Ltd., operator. [Nissho Iwai Corp. (Japan), 100%]	Tomago Mines, NSW	30
Do.		Westralian Sands Ltd., 100%	Yoganup Extended and Yoganup North Mines, WA	30

e/ Estimated. NA Not available.

1/ Data are rounded to three significant digits.

2/ NSW New South Wales; NT Northern Territory; QLD Queensland; SA South Australia; TAS Tasmania; VIC Victoria; WA Western Australia.

3/ Full capacity planned for 1998; initial capacity in 1995 was approximately 16,000 metric tons per year of copper-in-concentrates.

4/ Mine scheduled to come on-stream in 1998.

5/ Plant produces 24,000 metric tons per year electrofused magnesia and 90,000 metric tons per year dead-burned magnesia.

TABLE 3
AUSTRALIA: RESERVES OF MAJOR MINERAL COMMODITIES

(Thousand metric tons unless otherwise specified)

Commodity		Reserves
Antimony		88.1
Bauxite	million metric tons	2,538.0
Black coal:		
In situ	billion metric tons	69.0
Recoverable	do.	49.0
Brown coal:		
In situ	do.	46.0
Recoverable	do.	41.0
Cadmium		73.4
Cobalt		52.0
Columbium		3.4
Copper	million metric tons	20.2
Diamond:		
Gem and near gem	million carats	130.0
Industrial	do.	168.0
Gold	metric tons	3,434.0
Iron ore	billion metric tons	18.0
Lead	million metric tons	19.7
Lithium		159.0
Magnesite (MgO_2)	million metric tons	246.9
Manganese ore	do.	124.0
Mineral sands:		
Ilmenite	do.	132.5
Rutile	do.	14.4
Zircon	do.	21.0
Nickel	do.	2.9
Petroleum, recoverable:		
Condensate	billion liters	133.0
Crude	do.	244.0
Liquefied petroleum gas	do.	135.0
Natural gas	billion cubic meters	1,006.0
Platinum-group metals 1/	metric tons	17.7
Rare earths 2/		1,000.0
Silver		44.7
Tantalum		6.2
Tin		159.0
Tungsten		1.0
Uranium, recoverable	metric tons	633.0
Vanadium		15.0
Zinc	million metric tons	42.6

1/ Platinum, palladium.

2/ Rare earth oxides plus yttrium oxide.

Source: Mineral Resources Branch, Bureau of Resource Sciences, Canberra, Australia.

THE MINERAL INDUSTRY OF

BANGLADESH

By Chin S. Kuo

Bangladesh produced cement, clay, limestone, salt, and steel in minor quantities relative to world output. The only economically important mineral commodities produced were natural gas and nitrogen fertilizer. *(See table 1.)*

During the year, the top five investment projects worth \$140 million[1] included a \$75-million steel venture with India, Japan, and the United States and a \$40-million telecommunications venture with Malaysia.

Standard Chartered Bank was expected to start an offshore banking unit at the Chittagong export processing zone. The unit would be able to accept deposits and borrow funds from outside the country. Foreign and joint-venture companies would be able to obtain loans.

The Government introduced a ban on the import of granular single superphosphate (SSP) effective May 1, 1995. Imports of powdered SSP were not affected. Imports of triple superphosphate and SSP were around 400,000 metric tons per year (t/yr).

Bangladesh Chemical Industries Corp. (40%) signed a joint-venture agreement with Swaraj Import Export (20%) of India and Luna Consultant Jersey (40%) of the United Kingdom to establish a \$7.5-million SSP plant in the Khulna-Jessore region of southwest Bangladesh. The plant would produce 132,000 t/yr of SSP and 6,600 t/yr of oleum. The project was expected to be on-stream in 1997.

BHP Minerals Division of Australia started seismic operations to explore for coal at three sites in northern Rangpur and Dinajpur districts. Drilling was expected to begin in 1996. The agreement with the Government covers a region of 14,000 hectares.

The International Development Association unit of the World Bank would lend Bangladesh \$120.8 million as part of a \$171.7-million project to develop the natural gas sector. Overseas Development Agency of the United Kingdom would provide \$26.9 million for the project. Part of the project would be a 58-kilometer pipeline from Ashuganj to Bakhrabad. In addition, three production wells would be drilled in the Rashidpur Gasfield which had a remaining recoverable reserves of 36.2 billion cubic meters (m^3).[2] A gas processing plant was included for Rashidpur.

The Iranian private sector, in a joint venture with the Government, planned to construct an oil refinery in Bangladesh in 1995. The refinery, to be developed by the Pacific Asia Co., would have a processing capacity of 80,000 to 100,000 barrels per day.

Cairn Energy and Midlands Power International signed a memorandum of understanding to appraise and possibly develop the Semutang Gasfield for a power generation project. The Semutang Gasfield had estimated recoverable reserves of 2.83 billion m^3 of gas.[3] Midlands Power International would acquire a 30% interest in the production sharing contract and would be responsible for the development of a proposal for a new 40-megawatt (MW) powerplant on the basis of build, own, and operate. Cairn Energy had an option to take a 30% stake in the power project.

The Asian Development Bank agreed to provide \$130 million in soft loans for two power projects. It would lend \$80 million to the power transmission and distribution project in Dhaka and \$50 million to the 300-MW diesel-fired Meghnaghat powerplant. The projects were slated for completion by 1998.

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[1] Where necessary, values have been converted from Bangladesh taka (Tk) to U.S. dollars at the rate of Tk40.25 = US\$1.00 for 1995.

[2] Petroleum Economist. June 1995, p. 140.

[3] Petroleum Economist. June 1995, p. 140.

Major Sources of Information

Ministry of Energy and Mineral Resources
Dhaka, Bangladesh
Bangladesh Oil, Gas and Mineral Corp.
122-124 Motijheel Commercial Area
Dhaka, Bangladesh
Bangladesh Petroleum Corp.
GPO Box 2003
Dhaka, Bangladesh

Major Publications

Bangladesh Bureau of Statistics, Dhaka:
Monthly Statistical Bulletin of Bangladesh.
Statistical Yearbook of Bangladesh.

TABLE 1
BANGLADESH: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993 e/	1994 e/	1995 e/
Cement, hydraulic 3/		274,551	272,577	275,000	280,000	280,000
Clays, kaolin 3/		7,338	7,300 e/	7,500	3,283 4/	6,541 4/
Gas, natural, marketed 3/ 5/	million cubic meters	4,893	5,740	6,000	5,974 4/	6,000
Iron and steel, metal: 3/						
Steel, crude (ingot only)		57,520	36,384	32,000	34,000	36,000
Steel products		95,016	90,000 e/	85,000	87,000	88,000
Nitrogen, N content of urea, ammonia, and ammonium sulfate		667,300	936,800	990,900 4/	995,000	975,000
Petroleum:						
Crude	thousand 42-gallon barrels	1,200 e/	1,100 e/	1,300	1,184 4/	1,190
Refinery products	do.	7,600 e/	7,700 e/	7,800	7,600	7,700
Salt, marine e/ 3/		300,000	320,000	340,000	350,000	350,000
Stone, limestone 3/		42,484	47,000 e/	50,000	25,679 r/ 4/	23,474 4/

e/ Estimated. r/ Revised.

1/ Table includes data available through Aug. 20, 1996.

2/ In addition to the commodities listed, crude construction materials such as sand and gravel and other varieties of stone presumably are produced, but available information is inadequate to make reliable estimates of output levels.

3/ Data are for years ending June 30 of that stated.

4/ Reported figure.

5/ Gross production is not reported; the quantity vented, flared, or reinjected is believed to be negligible.

THE MINERAL INDUSTRY OF

BHUTAN

By John C. Wu

The mineral resources of Bhutan include beryl, coal, copper, dolomite, graphite, gypsum, iron, lead, limestone, marble, mica, pyrite, quartzite, slate, silver, talc, tin, tungsten, and zinc.

Information about most of Bhutan's mineral resources was sparse, largely because much of the country is extremely mountainous and lacks roads. Systematic exploration and geologic mapping in Bhutan by the Division of Geology and Mines of the Ministry of Trade and Industry, assisted by the Geological Survey of India, were still at an early stage. However, the Himalayas were known to include thick sequences of carbonate rocks and mineral reserves of dolomite, limestone, and quartzite were considered to be quite large.

Bhutan's economy was one of the least developed in the world and was largely dependent on foreign financial and technical aid from India, Japan, and international organizations. Bhutan's economic development requires upgrading of its infrastructure, such as highway network improvement and expansion, telecommunication modernization, and hydroelectric power generation capacity expansion.

In 1995, the minerals production of Bhutan included coal, dolomite, gypsum, limestone, marble, quartzite, sand and gravel, slate, and talc. (*See table 1.*) Bhutan also processed some of its industrial minerals to produce cement and ferrosilicon for export. Most dolomite, gypsum, and limestone were mined for the manufacture of cement and calcium carbide. Quartzite was mined for the production of ferrosilicon and microsilica. Most cement and all calcium carbide were exported, mainly to India, and most ferrosilicon was exported, mainly toIndia and Japan.

According to the Division of Geology and Mines, most industrial minerals mining was by privately owned companies. Mining of coal was by Penden Drukpa Coal Mines, a joint venture of the Government and a local private company, at Bangtar, Chenangri and Deothang in the southeastern part of Bhutan. Mining of dolomite was by Chundu Enterprise at Khagrikhola and Pugli and by Bhutan Mining Enterprise at Pugli, all in the Samchi District in the southwestern part of Bhutan; by Tashi Commercial Corp. at Kalesore; and by Singye Dolomite Industries at Duarpani in the Samdrup-Mongar and Shemgang districts in the southeastern part of Bhutan. Mining of gypsum was by the State-owned Shumar Gypsum at Khothakpa near Pemagatsel in the southeastern part of Bhutan. Mining of marble was by Bhutan Marble and Minerals at Gidakhom. Mining of slate was by the state-owned Sha Slate Mine at Sha Bhel. Mining of talc was by Penden Cement Authority at Kalapani.[1]

Quartzite mining for ferrosilicon production was by Bhutan Ferro Alloys Ltd.(BFAL) at Tintali, by Dendup Enterprise at Suktikhola, and by Bhutan Stone and Minerals Exporting Co. at Kamji. Limestone mining for calcium carbide production was by Bhutan Carbide and Chemical Ltd. at Haurie Khola and at Rongri. Limestone mining for cement production was by the state-owned Penden Cement Authority at Pugli, Yangzom Cement at Duarpani, Namgyel Cement at Kalesore, and Lhaki Cement at Titi.

Bhutan's cement industry, comprised of two state-owned companies and two privately owned small cement works, had a combined annual capacity of 160,000 metric tons (t). The state-owned Penden Cement Authority, the largest, operated a 300-metric-tons-per-day (t/d) rotary kiln with suspension preheater at Pugli in the southwestern part of Bhutan. Penden Cement also operated two 50-t/d vertical shaft kilns at Gomtu under the name of Lhaki Cement. The two privately owned cement companies were Namgyel Cement, operating a 100-t/d plant at Pasakha, and Yangzom Cement, operating a 30-t/d plant at Samchi. In 1995, a new cement plant with a designed capacity of 500-t/d was under construction at Nanglam in the southeastern part of Bhutan by a foreign investor from India.[2]

BFAL began operation of its 30,000-kiovolt-ampere electric furnace for production of ferrosilicon at Pasakha, near Punchholing in southwestern Bhutan in October 1994. The plant was officially inaugurated in March 1995 and began commercial production in April. According to TEX report, a Japanese trading journal, about 4,000 t of ferrosilicon had been produced between October 1994 and March 1995. Because of higher ferrosilicon prices in India, BFAL planned to export most of its output to India.[3]

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[1] Geological Survey of Japan (Tsukuba). "Industrial Mineral Resources of Bhutan and Their Development." By Yukio Togashi, in Chishitsu News, No. 485, Jan. 1995, p. 34.

[2] International Cement Review. "Bhutan, Where Dragons Thunder." Dec. 1995, p. 62.

[3] The TEX Report (Tokyo). "Bhutan Fe-Si Started Officially Commercial

Production." V. 27, No. 6335, Apr. 14, 1995, p. 3.

Major Sources of Information

Ministry of Trade and Industry

Division of Geology and Mines
Thimphu, Bhutan
Telephone: 975-223013/222879
Fax: 975-2233507

TABLE 1
BHUTAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
Cement		115,590 r/	116,420 r/	107,810 r/	120,000 r/ e/	140,000 e/
Coal		38,500	56,000	56,000	63,912	71,112
Dolomite		275,000 r/	270,000 r/	206,000 r/	212,629 r/	249,253
Ferrosilicon		--	--	--	2,000 e/	12,000 e/
Gypsum		26,700 r/	25,000 r/	20,000 e/	45,097 r/	52,102
Limestone		136,000 r/	167,000 r/	190,000 r/	232,317 r/	266,591
Marble	square meters	918	4,130	3,825	2,841	3,946
Quartzite		--	--	--	15,647	49,900
Talc		--	--	--	169	3,332

e/ Estimated. r/ Revised.

1/ Table includes data available through Aug. 27, 1996.

2/ In addition to the commodities listed, crude construction materials, such as sand and gravel and a variety of stone, presumably are produced, but information is inadequate to make reliable estimates of output levels.

Sources: Ministry of Trade and Industry, Royal Government of Bhutan.

THE MINERAL INDUSTRY OF

BRUNEI

By John C. Wu

Brunei, a small, oil-rich country on the northwest coast of Borneo Island in Southeast Asia, had extensive reserves of petroleum and natural gas. According to the U.S. Oil and Gas Journal, Brunei's proven reserves of crude petroleum were 1.35 billion barrels and natural gas, 396.44 billion cubic meters (m^3). In 1995, Brunei was the world's fourth largest producer of liquefied natural gas (LNG). In the Asia and Pacific region, Brunei ranked sixth in crude petroleum production and seventh in natural gas production.

Brunei's mineral industry was comprised of an oil and gas company engaged in the production of crude petroleum, refined petroleum products, and natural gas; a company involved in the production and marketing of LNG; and several small-scale industrial minerals companies engaged in the mining of crude construction materials, such as sand and grave and other varieties of stone.

Because of the decline in oil and gas prices during the past few years, the oil and gas sector's contribution to Brunei's gross domestic product dropped from 62% in the late 1980's to about 40% in the first half of the 1990's. However, the oil and gas sector remained the main engine of Brunei's economic growth in 1995.

Exports of crude petroleum, natural gas, in the form of LNG, and refined petroleum products were estimated to account for about 95% of Brunei's export earnings, which were estimated at $2.5 billion in 1995. About 45% of export earnings were from exports of LNG, 44% from crude petroleum, and 7% from refined petroleum products. Japan was the dominant buyer of Brunei's crude petroleum and LNG. The Republic of Korea, Singapore, and Thailand were other major buyers of Brunei's crude petroleum and refined petroleum products in 1995.

Production of oil and gas by Brunei Shell Petroleum Co. Sdn. Bhd. (BSP) was from seven offshore fields-South West Ampa, Champion, Magpie, Fairley, Fairley-Baram, Gannet, and Iron Duke- and from two onshore fields in Serai and Rasau. BSP, the sole oil and gas producer in Brunei, was a 50-50 joint venture of Royal Dutch Shell Group Co. and the Government of Brunei.

Production of crude petroleum by BSP decreased to an average of 159,000 barrels per day (bbl/d) in 1995 from an average of 162,000 bbl/d in 1994. About 65% of the crude petroleum production was from South West Ampa and Champion Fields. Production of natural gas was about 9.8 billion m^3, of which more than 95% was from South West Ampa, Champion, and Fairley Fields.

To meet domestic demand for refined petroleum products, BSP operated a 8,600-bbl/d petroleum refinery at Seria. Major refined petroleum products included gasoline, distillate fuel oil, and jet fuel. Brunei LNG Sdn. Bhd. purchased natural gas from BSP and produced LNG at the Lumut LNG plant with a capacity of 5 million metric tons per year (Mt/yr). The company had made considerable investment to upgrade its LNG production facilities and constructed a new side-loading berth for LNG export to the Republic of Korea and other countries. Exports of LNG were estimated at about 6.2 million metric tons and valued at about $1.2 billion in 1995. Most of the LNG output was exported to Japan under a new 20-year contract signed in 1993. Under this long-term contract, Brunei was to export 5.54 million metric tons per year of LNG to Japan. Brunei also exported about 700,000 metric tons of LNG to the Republic of Korea in 1995.

Major Sources of Information

Mining and Quarrying Unit
Ministry of Industry and Primary Resources
Bandar Seri Begawan
Brunei Darussalam

TABLE 1
BRUNEI: PRODUCTION OF MINERAL COMMODITIES e/ 1/

Commodity 2/		1991	1992	1993	1994	1995
Gas, natural:						
Gross	million cubic meters	9,200	9,500	9,600	9,800	9,600
Marketed	do.	8,240	8,700	8,800	9,000	8,800
Natural gas liquids:						
Condensate	thousand 42-gallon barrels	4,000	4,500	4,600	4,700	4,600
Natural gasoline	do.	290	290	290	290	290
Liquefied petroleum gas	do.	90	90	90	90	90
Total	do.	4,380	4,880	4,980	5,080	4,980
Petroleum:						
Crude	do.	59,100	59,700	57,600	59,200	58,000
Refinery products:	do.					
Gasoline	do.	630	620	630	620	620
Distillate fuel oil	do.	450	430	440	430	430
Residual fuel oil	do.	10	10	10	10	10
Other including refinery losses	do.	350	330	340	330	340
Total	do.	1,440	1,390	1,420	1,390	1,420

e/ Estimated.

1/ Table includes data available through Aug. 28, 1996.

2/ In addition to the commodities listed, crude construction materials such as sand and gravel and other varieties of stone presumably are produced, but available information is inadequate to make reliable estimates of output levels.

THE MINERAL INDUSTRY OF

BURMA

By John C. Wu

In 1995, Burma[1] produced metallic minerals, industrial minerals, and mineral fuels. Its metallic minerals production included copper, gold, lead, manganese, nickel, silver, tin, tungsten, and zinc. Its industrial minerals production included barite, clays, dolomite, feldspar, gypsum, limestone, salt, and precious and semiprecious stones. Its mineral fuels production included coal, natural gas, and crude petroleum. *(See table 1.)*

The Ministry of Mines was responsible for establishing Burma's mining legislation and implementing its mineral policy. The Ministry of Mines also controlled three State-owned mining enterprises and a State-owned gems enterprise. Under the Ministry, the Department of Planning and Work Inspection established mining legislation governing mining rights, mine safety, environmental protection, and conducted mine inspections. The Department of Geological Survey and Mineral Exploration was in charge of the geological mapping and minerals survey and exploration. The Ministry of Energy was responsible for petroleum and natural gas exploration and development.

The mineral industry comprised three State-owned metals mining enterprises, a State-owned gems enterprise, a State-owned oil and gas enterprise, several Government and private joint-venture companies, and many small-scale private and local enterprises. According to the Ministry of National Planning and Economic Development, the total work force in the mining sector was about 105,000, accounting for 0.61% of Burma's labor force in 1995. The total output of the mining sector, in 1986 constant producers' prices, was estimated at $141 million,[2] or about 1.3% of Burma's gross domestic product, which was estimated at $10.8 billion in 1995.

After the Government opened 16 blocks of land to foreign investors for exploration and development of copper, gold, platinum-group metals, and associated minerals in central and upper Burma in November 1994, 26 companies from Australia, Canada, China, Indonesia, Malaysia, Singapore, South Africa, and the United States participated in competitive bidding.[3] By August 1995, 12 blocks of land and 2 promising gold deposits were awarded to companies from Australia, Canada, Singapore, and the United States. As a result, direct foreign investment in the mining sector increased to $189.5 million for 20 approved projects in July 1995 from $163.5 million for 11 approved projects in June 1994.[4] In October 1995, the Government offered 11 more blocks of land to attract local and foreign investors to explore for nonferrous and precious metals in central and lower Burma. Three blocks were for gold, one for copper, five for lead and zinc, one for nickel, and one for platinum-group metals. Each block of land was about 1,400 square kilometers.

Mine production of copper by the State-owned No. 1 Mining Enterprise was from an open pit mine at the Sabetaung deposit in Salingyi Township, about 11 kilometers (km) west of Monywa. Ivanhoe Myanmar Holdings Ltd. (IMH), a joint venture of Ivanhoe Capital of Canada and the Government, continued its exploration of copper to extend ore reserves at the Kyisingdaung and Letpadaung Taung deposits in the Monywa area.

In September 1995, IMH and No. 1 Mining Enterprise jointly opened a pilot plant in Salingyi Township to produce refined copper using solvent extraction-electrowinning technology. In February 1995, the Government signed agreements with IMH and First Dynasty Mines Ltd. (FDM) of Canada for exploration of copper, gold, and associated minerals. IMH was awarded blocks 3, 4, 5, 6, 6A, and 7; and FDM was awarded blocks 2, 10, and 11, all in upper Burma.

Mine production of lead, silver, and zinc by the State-owned No. 1 Mining Enterprise was mainly from an open pit and an underground operation at the Bawdwin Mine in Shan State of northern Burma. Metal production of lead, silver, and byproducts, such as antimonial lead, copper matte, and nickel speiss, was from a lead-silver smelter at Namtu, near the Bawdwin Mine. No. 1 Mining Enterprise planned to explore and develop the Lonchain (Laungkeng) zinc deposit in the southern Shan State, near the Thai border in the next few years. A group of Thai companies recently discovered a rich zinc deposit at Wali on the Burma-Thailand border, near Kawkaraik in Kayin State. The deposit extends from Burma into Thailand. Across the Thai border, mine production had begun at a rate of between 300 metric tons per day (t/d) and 500 t/d of zinc ore in 1995. However, exploration for estimating ore reserves in the Wali area was not done because the area was controlled by insurgents in the past 40 years.[5]

Mine production of gold by the State-owned No. 2 Mining Enterprise was from the Phayaung Taung gold mine in Patheiygi Township, near Mandalay and from the Kyaukpahtoe Mine, a new joint-venture operation of the State-owned No. 2 Mining Enterprise and a local entrepreneur. For gold production, the Government signed a production-sharing contract with Pacific Arch Exploration NL of Australia (PAE) in February 1995 for exploration and development of an alluvial gold deposit near the village of Mansi, about 450 km north of Mandalay. In May 1995, the Government signed a second production-sharing contract with Sum Cheong Resources Pte. Ltd. (SCR) of Singapore for gold production at the Phayaung Taung gold mine in block 15. SCR planned to invest $1.1 million for further exploration at the mine site in 1996. For gold exploration, the Government signed agreements with PAE in February 1995 and with East Asia Gold Corp. (EAG) of the United States and International Panorama Resources (IPR) Ltd. of Canada in August. PAE was awarded blocks 8 and 13; EAG, block 14; and IPR, block 9.[6]

Production of tin and tungsten by the State-owned No. 2 Mining Enterprise was from the Mawchi Mine in Kayah State, the Heinda (open pit mine) in Tavoy Township, the Theindaw area of Tenasserim (Tanintharyi) Division, and from an unnamed area in Namhkam Township, northern Shan State, a joint-venture project of the No. 2 Mining Enterprise and Shweli Mining Corp. of China. At the Theindaw Mine, considerable amounts of gem-quality diamond were recovered as byproduct of tin concentrate. There was no primary diamond mine in Burma.

Burma also produced a variety of industrial minerals in small quantities and significant amounts of precious and semiprecious stones. Production of barite, bentonite, clays, dolomite, feldspar, gypsum, limestone, and salt was for the domestic market. Production of diamond, jade, rubies, and sapphires was for export.

The State-owned Myanma Ceramic Industries operated three cement plants. Cement plant No. 1, at Thayet in Magway Division, had an operating capacity of 125,000 metric tons per year (t/yr). Cement plant No. 2, in Kyangin Township of Ayeyarwaddy Division, had an operating capacity of about 250,000 t/yr. Cement plant No. 3, at Hpa-an Township of Kayin State, had an operating capacity of 192,000 t/yr. Because of the growing demand for cement, production of cement reached a record high level in 1995. Increased construction activity caused some cement shortages in the Rangoon and Mandalay areas. As a result, Burma's cement imports rose considerably in 1995.

The State-owned Myanma Gems Enterprise operated gem mines at the Mogok Stone Tract for rubies and sapphires and at the Jade Mines area for jade. Since 1993, both the State-owned enterprise and private companies have participated in ruby and jade mining at the Mongshu Stone Tract in eastern Burma; at the Pyinlon (Nawarat) Stone Tract in northern Burma near the Chinese border; and at Nathmaw and Manshibon in northwestern Burma, where high-quality jade was found. At the Mongshu gemstone tract, high-quality rubies and lower quality rubies containing iron were found recently. Myanma Gems Enterprise held its 32d gems, jade, and pearl emporium in March 1995 and had a total sales of $7.2 million, of which $5.4 million was from sales of jade.[7] The emporia had been held twice a year at the Myanma Gems Emporium Hall in Kaba-Aye Pagoda Road, Yangon. Gems and jewelry exports contributed about 4% to the country's total export earnings.

Production of coal was by the State-owned No. 3 Mining Enterprise at Namma in Shan State and at Kalewa in Sagain Division. Namma's coal was of lignite grade and Kalewa's coal, subbituminous grade. Coal was consumed mostly by the domestic iron and steel industry.

Production of crude petroleum and natural gas was by the State-owned Myanma Oil and Gas Enterprise, which operated 17 onshore oilfield and gasfields. Production of natural gas from the Aphyauk Gasfield, near Taikkyi Township in the lower delta of Ayeyarwady Division, rose to 2.12 million cubic meters per day (Mm^3/d) in 1995 from 1.1 Mm^3/d in 1994. Natural gas produced from 10 wells at the Aphyauk Gasfield was piped to Yangon and Pyay for power generation at Thaketa, near Yangon; and at Shwedaung, near Pyay; and for industrial use at the Sittaung Paper Mill in Yangon. Natural gas production from the Aphyauk Gasfield would be raised further to 2.8 Mm^3/d when a 224-km pipeline network is completed in 1996. The new pipeline will supply natural gas to two powerplants at Ywama and Myanaung, a cement plant at Kyangin, and a methanol plant at Seiktha.

To utilize offshore natural gas resources for the domestic market and for export to Thailand, Myanmar Total Exploration, a joint venture of Total Oil Co. of France (36.75%), Unocal Oil Co. of the United States (33.25%), and Petroleum Authority of Thailand (30%) was developing the Yadana Gasfield, which contains 192 billion cubic meters (m^3) of gas reserves and is about 320 km southwest of Yangon. Texaco Exploration Myanmar, a joint venture of Texaco Oil Co. of the United States (50%), Premier Consolidated of the United Kingdom (30%), and Nippon Oil Corp. of Japan (20%), was developing the Yetagun Gasfield which contains 48 billion m^3 of gas reserves and is about 450 km southeast of Yangon.[8]

In August 1995, the Government signed a major agreement with Mitsui & Co. of Japan to building a pipeline to deliver natural gas from offshore Yadana Gasfield to a powerplant and a fertilizer plant in a coastal industrial complex near Yangon. The $700 million natural gas development project included construction of a 250-km pipeline network, a 200-megawatts gas turbine powerplant, and a 570,000-t/yr urea fertilizer plant. Completion of the project would be linked to the commercial operation of Yadana Gasfield in August 1998.[9]

For oil and gas exploration, the Government signed three new production-sharing contracts separately with Texaco Exploration Myanmar, with Empire Oil Co. (Pacific) Ltd.

of Australia, and with Atlantic Richfield Co. of the United States in 1995.

Major Sources of Information

The Ministry of Mines
90 Kanbe Road, Yankin
Yangon, Myanmar (Burma)
Telephone: 95-1-57457, 52683, 52090
Fax: 95-1-57309

Major Publications

The Ministry of National Planning and Economic Development, Central Statistical Organization: Statistical Abstract, annually.

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[1] Burma also is known as Myanma. Burma is the conventional short form of Union of Burma. Pyidaungzu Myanma Naingngandaw is translated by the US Government as Union of Myanma and by the Burmese as Union of Myanmar.

[2] Where necessary, values have been converted from Burmese Kyats (K) to U.S. dollars at the rate of K5.7=US$1.00 in 1995.

[3] Engineering and Mining Journal. "On the Road to Burma." V. 196, No. 10, Oct. 1995, p. 14.

[4] Ministry of National Planning and Economic Development (Yangon). Economic Development of Myanmar, June 1994, p. 32.

The Asian Wall Street Journal Weekly (Hong Kong). "Western Firms Remain Hesitant About Investing In Burma." V. 17, No. 36, Sept. 4, 1995, p. 8.

[5] U.S. Embassy, Rangoon, Burma. State Dep. Telegram 001160, Mar. 15, 1995, p. 1.

[6] Myanmar Business (Manila). "Feasibility Studies for Developing Gold and Copper Resources." V. 2, No. 11, Oct. 4, 1995, p. 4.

[7] ———. "Gems & Jewelry." V. 2, No. 6, June 7, 1995, pp. 5-6.

[8] ———. "Oil and Gas Notes." V. 2, No. 10, Oct. 1995, pp. 2-3.

Petroleum Economist (London). V. 62, No. 3, p. 43; V. 62, No. 4, p. 35.

[9] The Nikkei Weekly (Tokyo). "Mitsui in Myanmar Gas Venture." V. 33, No. 1687, Sept. 4, 1995, p. 21.

TABLE 1
BURMA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1991	1992	1993	1994	1995 p/
METALS					
Chromium: Chromite, gross weight e/	1,000	6,200	1,000	1,000	--
Copper:					
Mine output, Cu content	4,592	3,731	3,581	5,025 r/	3,700 e/
Matte, gross weight	73	45	42	37 r/	30 e/
Gold, mine output, Au content e/ kilograms	51	48	63	70	90
Iron and steel:					
Pig iron	568	1,409	1,500 e/	940 r/	1,500 e/
Steel, crude e/	25,000	15,000	25,000	25,000	25,000
Lead					
Mine output, Pb content e/	2,750	2,800	2,200	2,300	2,400
Metal:					
Refined	2,177	2,122	1,561	1,797 r/	1,753
Antimonial lead (93% Pb)	108	71	38	40	50 e/
Manganese mine output, Mn content e/	78	49	43	60 r/	50
Nickel:					
Mine output, Ni content e/	15	9	67	50 r/	50
Speiss (matte), gross weight	59	35	259	74 r/	100 e/
Silver, mine output, Ag content kilograms	5,256	4,790	2,395	5,629 r/	3,500 e/
Tin, mine output, Sn content:					
Of tin concentrate	130	214	314	416 r/	372
Of tin-tungsten concentrate	308	435	375	398 r/	375
Total	438	649	689	814 r/	747
Metal: refined	157	189	170	200	190 e/
Tungsten, mine output, W content:					
Of tungsten concentrate	6	35	70	89 r/	93
Of tin-tungsten concentrate	350	496	454	455 r/	438
Total	356	531	524	548 r/	531
Zinc, mine output, Zn content	996	1,078	850	1,316 r/	719
INDUSTRIAL MINERALS					
Barite	11,339	13,589	15,628	21,969 r/	34,601
Cement, hydraulic	442,695 r/	464,495 r/	400,031 r/	469,582 r/	516,931
Clays:					
Ball clay	200	230	255	--	--
Bentonite	684	693	200	795 r/	500 e/
Fire clay and fire clay powder	1,357	1,500	2,154	2,413 r/	2,300 e/
Feldspar	3,737	1,618	6,289	6,976 r/	7,000 e/
Graphite	36	--	--	--	--
Gypsum	33,556	30,933	27,835	38,136 r/	34,659
Nitrogen: N content of fertilizer	111,000	130,000	130,000 e/	130,000 e/	130,000 e/
Precious and semiprecious stones:					
Jade kilograms	149,790	162,964	223,980	316,543 r/	702,751
Diamond carats	111	252	169	48 r/	10
Rubies, sapphires, spinel do.	224,672	243,109	254,753	185,418 r/	175,000 e/
Salt e/ 3/ thousand tons	260	260	260	260	260
Stone:					
Dolomite	2,856	2,100	1,248	4,115 r/	3,432
Limestone, crushed and broken thousand tons	1,910	2,083	2,134	2,300 e/	2,500 e/
MINERAL FUELS AND RELATED MATERIALS					
Coal, lignite	36,337	33,573	31,654	35,856 r/	32,191
Gas, natural:					
Gross e/ million cubic meters	936	913	1,054	1,308	1,476
Marketed do.	916	894	1,031	1,280	1,446
Petroleum:					
Crude thousand 42-gallon barrels	4,887	5,497	5,205	5,188 r/	4,393
Refinery products 4/ do.	4,250	4,395	4,516	4,627 r/	5,313

e/ Estimated. r/ Revised. p/ Preliminary.

1/ Table includes data available through May 28, 1996.

2/ In addition to the commodities listed, pottery clay, silica sand, construction aggregate, and varieties of gemstones are produced, but available informatio inadequate to make reliable estimates of output levels.

3/ Brine salt production (in metric tons) reported by the Government was : 1991--46,835; 1992--46,509; 1993--58,915; 1994--58,612; and 1995--81,156.

4/ Includes gasoline, jet fuel, kerosene, diesel, distillate fuel oil, and residual fuel oil.

Source: Ministry of Mines and Central Statistical Organization (Yangon), Statistical Abstract 1994, pp. 63-66.

THE MINERAL INDUSTRY OF

CAMBODIA

By Chin S. Kuo

The country suffered many years of warfare that virtually destroyed its infrastructure. Industrial activity was very limited and small-scale. Economic recovery was slow, and the gross domestic product per capita was only $630[1] in 1994. The International Monetary Fund pledged $120 million in aid for 1995-98. The mining sector was insignificant and the mineral industry consisted of a small cement plant and producers of brick, clays, lime, and salt. Phosphate rock was mined sporadically by manual methods. Other mineral resources reportedly included gemstones, iron ore, and manganese. *(See table 1.)*

Coal resources exist in many parts of the country, and there are promising hydrocarbon deposits. Like other underdeveloped countries in Asia, Cambodia imported construction materials, machinery, and petroleum products. The country also has significant potential hydroelectric capacity. Electricity supply was particularly poorly developed with no national grid. Small-scale diesel-powered plants had generating capacity less than 100 megawatts. Electricity consumption per capita was 14 kilowatt hours. Priority in the energy and electricity sectors would be given to hydrocarbon and hydroelectric developments.

A total of 17 foreign companies submitted bids to explore for oil and gas in one onshore and three offshore blocks in Cambodia. The offshore areas are blocks 5, 6, and 7 near the Port of Sihanoukville on the Gulf of Thailand. The onshore block 10 is connected to block 6. Cambodia's production-sharing contract has a 6-year exploration period, with a flexible appraisal period. It stipulates a 12.5% fixed royalty to the Government during production. The contract allows contractors to recover all allowable exploration and development costs over a 5-year period. One of three foreign consortia, mainly British and French companies, holds offshore blocks 1 and 2. The Japanese-controlled consortium was awarded block 3. Block 4 was awarded to a Japanese-Australian consortium.

Major Source of Information

Ministry of Industry, Mines, and Energy
Phnom Penh, Cambodia

TABLE 1
CAMBODIA: PRODUCTION OF SELECTED MINERAL COMMODITIES e/ 1/

(Metric tons)

Commodity 2/	1991	1992	1993	1994	1995
Salt	40,000	40,000	40,000	40,000	40,000

e/ Estimated.
1/ Table includes data through Aug. 29, 1996.
2/ In addition to the commodity listed, cement, clays, lime, phosphate rock, and crude construction materials, such as sand and gravel and varieties of stone, presumably are produced, but available information is inadequate to make reliable estimates of output levels.

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[1] Where necessary, values have been converted from Cambodian riels (CR) to U.S. dollars at the rate of CR2,470=US$1.00 for 1995.

THE MINERAL INDUSTRY OF

CHINA

By Pui-Kwan Tse

In 1995, China's economic reform remained in a crucial transition period from a planned economic system to a market-oriented system. The Government had embarked on a social market economic system in 1993, however, the practice of a planned economic system was continuously adopted in many governmental policies.

The Chinese Government continued to implement its macroeconomic regulations to control the rapidly growing economy and to curb inflation. Since July 1993, the Government imposed tightened credit policies which have adversely affected struggling state-owned enterprises and also exacerbated problems of triangular debt; that is, the ability of state-owned enterprises to pay each other for goods and services. A Chinese economist estimated that the debt value between state-owned enterprises was more than $84 billion[1] in the first half of 1995. The 2 years of tight credit policies also affected the profit margins and sales of many companies. Profits shrank and stock prices dropped from their peak in January 1994 to historic lows. Companies whose main customers were domestic state-owned enterprises had been affected by the credit squeeze. These outstanding loans and unpaid bills would not be repaid in the near future. Writeoffs for these debts could easily wipe out their 1995 earnings. Retailers and companies having strong export markets were better off in the tight-credit climate. According to an official from the People's Bank of China (PBC), the Government would continue maintaining tight credit and price control policies in 1996. The Government would loosen its tight credit policies for the cash-poor agricultural sector by up to 30% and also allow 1,000 key state-owned enterprises that were unable to borrow fresh money from state banks to meet payroll obligations, to convert debts into equity.

In mid-1995, the State Council announced that, except for major construction projects that had been previously approved by the central Government, no local government could start any large- or medium-size new construction projects. In addition, no small capital projects would be allowed except those related to agriculture, water conservation, environmental protection, or modest residential projects. New technological renovation projects would undergo more scrutiny in order to assure that they must meet the requirements of improving the industrial infrastructure, increasing productivity, and better utilizing mineral resources. Although under significant restrictions on investment in new construction projects, the total fixed-asset investment was $229 billion in 1995, 19% more than that of 1994.[2]

Preliminary statistics indicated that the gross domestic product (GDP) grew 10.2% to $695.6 billion in 1995. The inflation rate was 14.8% in 1995, nearly 7% lower than that of 1994. In 1995, per capita income was $469 in urban areas and $190 in rural areas.

Government Policies and Programs

The task of reforming state-owned enterprises proved to be more challenging and politically risky than expected, and so the Government decided to postpone the reform in 1995. Instead of allowing a large number of state-owned enterprises to declare bankruptcy for fear of sparking widespread social unrest, the Government stressed management reform and technological renovation. The Government also urged inefficient and money-losing enterprises to merge with profitable enterprises. The Government also tolerated widespread privatization of state-owned enterprises through shareholdings. State-owned enterprises remained under the control of the Government in order to ensure stability and to direct the economy.

The Government also planned to reform its financial system. In 1995, all four major state banks lost money on domestic currency operations. Banks were forced to pay depositors inflation adjusted interest rates; however, they were allowed to charge a relatively low state-set rate on loans to state-owned enterprises. The proposed banking plan included an easing of restrictions on interest rates, permitting banks to adjust loan rates within a prescribed range, and increasing the openness of the state bond market.

The Chinese Government planned to convert all its commodities-future exchanges in the country into nonprofit bodies having a membership system conforming to international practices. China's commodities-future exchanges had been embroiled by malfeasance in the past several years. The Government hoped that these changes would prevent brokers from influencing the exchanges by pursuing their own interests. Also, to avoid disasters resulting from improper operations, no experimentation with derivatives would be allowed without the approval of the securities committee under the State Council.

The Government tightened its control over Sino-foreign joint-venture policies. Under new securities regulations, state-owned enterprises were required to provide details of company assets to the central Government before forming joint ventures with foreign partners. Foreign partners were required to provide details on the amount of capital investment in a contract. The Government had the right to demand revision of an agreement if any laws or regulations had been overlooked. The new regulations were aimed at preventing mismanagement of state property and eliminating fraudulent enterprises.

The Chinese Government had set a 5-year timetable for the gradual unification of a tax rate for foreign venture in its Special Economic Zones with those of companies in the rest of China. Beginning on January 1, 1996, the Government planned to abolish the duty-free on import of raw materials for export-oriented businesses and to eliminate preferential treatment of imports of capital equipment for companies having foreign partners. Without these benefits, a company involved in foreign partnerships would add as much as 40% to its capitalization. In addition, a sino-foreign joint venture would also lose its exemption from the 17% value-added tax. The hardest hit would be capital-intensive, high-technology ventures that could not secure equipment in China. According to an official from the State Council Development and Research Center, these changes were to unify the tariff rates in accordance with the World Trade Organization practices and to ensure equal competition in a social market economy.[3]

The State Council approved China National Nonferrous Metals Industry Corp. (CNNC) to become a holding company in 1995. CNNC would set up a national association to manage the nonferrous industry and would focus on diversifying its business and tapping overseas resources and capital to secure the supply of raw materials needed for expansion. CNNC would select a few of its subsidiaries to be listed in the domestic stock market.[4]

Production

China produced 94 million metric tons (Mt) of crude steel in 1995, out of a total capacity of about 100 Mt. China only had an output capacity of about 280 Mt of iron ore from domestic resources, therefore, it required to import 41 Mt of iron ore to meet the gap between demand and domestic supply in 1995. The Government planned to expand total steel output capacity from the 1995 level of 100 Mt to 135 Mt by the year 2000. However, the domestic iron ore reserves contained only about 35% of iron and resources were limited. The potential for increasing its iron ore output capacity was doubtful; therefore, China was expected to become more reliant on imports of iron ore to meet its industrial demands in the next few years.

The demand for steel in China was lower than expected because the Government tightened credit policies. Market prices of most steel products have declined since October 1994. Prices of hot- and cold-rolled thin plate dropped from 3,440 yuan ($414) and 4,350 yuan ($524) in May 1994 to 3,350 yuan ($403) and 4,130 yuan ($498) in April 1995, respectively. The demand of premium-quality round bars and hot rolled silicon plate slumped because of lack of credit in the machinery and electrical equipment sectors. Prices of round bars and hot-rolled silicon plate declined more than 7% since yearend 1994. However, galvanized plate and tinplate were in great demand. The wholesale prices of these products were up to the ceiling prices imposed by the Government. Retail prices of galvanized plate and tin plate rose more than 20% since the end of 1994.[5]

China consumed about 700,000 metric tons (t) of stainless steel per year. Because of technological and output capacity problems, China's main stainless steel producers—Chongqing, Daye, Dalian, Fushun, Changcheng, and Shanghai—had a total annual output capacity of only 350,000 t. The price of stainless steel went up by 36% to 32,000 yuan per ton (yuan/t) ($3,855/t) in the first 6 months of the year. China imports about 400,000 t of stainless steel per year and was expected to continue imports for this level in the next several years because the country's supply of cold-rolled sheet was limited.

In order to stabilize steel market price and to reduce the steel stockpile, the Government asked steel enterprises to limit output and to expand steel exports in 1995. In 1995, 80 Mt of rolled steel were produced, a decrease of 5.1% from that of 1994. Inventory of steel products declined by 10% to 28 Mt in mid-1995. Because of technical difficulties, China continued to be in short supply of high-quality cold-rolled plate, galvanized sheets, tinplate, petroleum conduits, and high-pressure boiler tubes. The Customs General Administration of China reported that China imported 13.97 Mt of rolled steel in 1995, a decrease of 38% from that of 1994 while China exported 5.93 Mt of rolled steel in 1995, an increase of 240% from that of 1994. About one-half of the country's imported steel products were cold-rolled plates that were mainly thin plates with a thickness of 0.5 millimeters (mm). Because of strict Government controls on the scale of capital investment in construction sector, steel products remained in oversupply in China.[6]

Because of the steady rising prices in coal, electricity, petroleum, imported iron ore and steel scrap, the production cost for ferroalloys had increased for the past 2 years. In addition, because the Government tightened credit policies, steel producers were short of funds. Many steel producers were making price concessions for cash and trying methods to recoup money to buy raw materials and fuel. A growing number of enterprises were struggling to make a reasonable profit margin.

The Ministry of Metallurgical Industry (MMI) urged steel producers to concentrate on improving product quality instead of quantity. MMI planned to add more funds for the development of advanced technology on thin-slab casting, smelting reduction, and ultra-high-power electric arc furnace in the next 5 years. The Government hoped to reduce energy consumption from the present 1.55 t of standard coal equivalent (SCE) per ton of steel to 1.45 t SCE by the year 2000.[7]

The Chinese Government long-term plan for development of its nonferrous metals sector emphasized full utilization of its domestic and foreign funds, resources, and markets. In 1995, China produced 4.25 Mt of 10 metals—aluminum, antimony, copper, lead, magnesium, mercury, nickel, tin, titanium, and zinc. CNNC and its subsidiaries accounted for 2.35 Mt of that total. According to an official from CNNC, the corporation would restructure its operation structure in the next 5 years. CNNC planned to form several group companies as a means of streamlining its operations and trimming duplication. It would reduce the number of its subsidiary companies from 139 in 1995 to about 70 at the end of the decade. It would speed up the replacement of inefficient and polluting technology and equipment with advanced ones. The corporation planned to reduce its asset liability ratio to about 60% and to improve its metal products quality by the year 2000. To ensure the smooth operation, the Government set the 1996 output target of the 10 metals at 4.1 Mt, 200,000 t lower than the 1995 output target. The average output growth rate for the 10metals was set at 4% during the 1996-2000 period, which was lower than the 12% level of 1991-95. More foreign investment would be sought via joint ventures in the next several years. However, the Government would not allow wholly foreign-funded nonferrous metals operations in China.[8]

In China, the production of nonferrous metals was mainly for the domestic market, and this would continue into the next decade. Annual demand of aluminum metal was predicted to rise 60% by the end of this decade, from 1.56 Mt in 1994 to 2.5 Mt by the year 2000. The aluminum metal output capacity was based upon increased demand. China would have an aluminum metal output capacity of 2.19 Mt at yearend of 1996 and a further 1.8 Mt of capacity was planned in the future by the Government. China planned to become self-sufficient in aluminum production and to reduce its net imports of aluminum in 1996. In 1995, China's net imports of aluminum and its alloys was about 419,000 t. Electricity shortages were still the major problem for Chinese aluminum producers. In the summer of 1995, because of power shortages, aluminum smelters in northwest China had to curtail some of their production.

Even though the Government restricted use of aluminum by the construction sector, the construction sector was the biggest consumer for aluminum in China. It consumed about 450,000 t aluminum in 1995 and was expected to reach about 1 Mt by the year 2000. In 1995, the automotive sector consumed less than 100,000 t of aluminum metal. However, several automotive plants were under construction. Under the Government's Ninth-Five-Year Plan (1996-2000), the automotive sector would be one of the key development projects in China. China's car output was expected to increase from 1.1 million in 1995 to 2.8 million by the year 2000. Therefore, the demand for aluminum metal was expected to increase to about 200,000 t by the end of the decade.

Compared with other industries, the metal recycling industry remained small. State-owned metal enterprises focused more on primary metal production. There were some metal recycling plants, but these were small and family run. Scrap metal was mainly imported. The United States was the major aluminum scrap supplier to China. In 1995, China and Hong Kong imported a total of 107,530 t of aluminum scrap from the United States, 30% of the total U.S. exports. Most of Hong Kong's imports eventually was reexported to China. Pure scrap produced within aluminum smelters was remelted in-house with primary metal. Extrusion plants in the coastal provinces of China imported aluminum scrap for remelting because primary aluminum prices were high. Also, it was a major task to ship aluminum metal from the northwest producers to consumers in southeast China.[9]

In 1995, the output of refined copper was 843,000 t, an increase of 22% over the same period of 1994. Domestic mine production could not keep up with the pace of growth, leaving an enormous gap of unmet smelter demand for concentrate. Therefore, in 1995, China imported 480,000 t of copper ore, nearly twice as much as in previous years. In addition, China also imported 537,897 t of copper and its alloy in the same period. The expansion of the automotive, machine building, and electronic sectors increased copper use. China consumed about 1 Mt of copper, and this was expected to increase to at least 1.3 Mt by the year 2000.

China's long-term copper strategy was to secure a stable supply of ore and metal resources to meet the country's demand. The country moved from spot or 1-year contracts to pursuing joint-venture investment in foreign copper projects such as in Chile and Pakistan.

In 1995, weak world market prices for lead and zinc, as well as tight domestic supplies of concentrates, forced many Chinese smelters to close down their operations. The shortage of concentrates was particularly acute in the zinc sector. In 1995, the total supply of domestic zinc concentrates was about 750,000 t and the domestic demand was about 1.05 Mt, a shortage of about 300,000 t. China's two major zinc smelters—Huludao and Zhuzhou —were required to import around 100,000 t of zinc concentrates each. Although domestic zinc prices vary from region to region, the underlying trend of zinc prices had been a downward one since the second half of 1995. In general, zinc market prices were lower by 10% in December 1995 compared with those in June 1995.[10]

China, the largest tungsten producer in the world, cut its output because of the country's reduced reserves and low market prices. The domestic market prices for tungsten ores began to recover from the recession of the previous several years. Rising demand and falling output pushed the price by 150% more than that of 1994. Domestic demand for tungsten ore increased to 45,000 t while the output stayed around 30,000 t. Because of outdated equipment and outmoded technology, it was difficult to increase output capacity in a short time. More seriously, tungsten resources were gradually being depleted. Many local mines ceased operations. Many state-owned mines could only fulfill about 60% of their targeted output.

The Government assigned its tungsten export quotas to the China National Nonferrous Metals Imports and Exports Corp., a subsidiary of CNNC, and China National Metals and Minerals Imports and Exports Co. in 1996. The Government planned to cut the tungsten exports quota by

5%. The country would shift its focus from producing and exporting tungsten concentrates, ammonium paratungstate, and other intermediate chemicals to downstream value-added products.

The Government met with antimony producers in May 1995 to discuss the production and marketing situation in China. At the conclusion of the meeting, the Government imposed a floor price on antimony and issued instruction on specific measurements to restrict antimony production. The Government also approved the formation of the Chinese Antimony Producers Association to oversee the production of antimony. Guangxi, Guizhou, and Hunan continued to be the three major antimony-producing Provinces in China. These three provinces accounted for about 95% of China's total.[11]

Because of weak demand, antimony prices collapsed in 1995. In August 1994, the domestic market price of antimony went up to 36,000 yuan/t ($4,337/t). But, during the third quarter of 1995, the price of antimony slipped down to 27,000 yuan/t ($3,253/t). Even though the Government continuously stressed cuting back on production and reducing the export of antimony at low prices to stabilize output. In October 1995, the Board of Directors of the Joint Committee of Antimony Producers ordered all smelters to halt antimony production by the end of the month and ordered mines owned by the smelters to cut ore output by 50%.

In 1995, China planned to produce 19 Mt of phosphate rock. However, lack of rail transport capacity restricted the shipment of phosphate rock out of Guizhou, Yunnan, and other phosphorus-producing Provinces. Even though the Government had put phosphate rock on the priority list for shipment, many fertilizer plants in the north and the east of China remained operating under the level of their output capacity because of shortage of phosphate rock. The total production of phosphorus-based fertilizer only met about 67% of the demand. In 1995, chemical fertilizer prices continuously rose in China. This triggered complaints from farmers and other consumers. The Government decided to the freeze prices of fertilizer in the last quarter of 1995.

Trade

According to the General Administration of Customs of China, total foreign trade reached $280.9 billion, accounting for about 46% of China's GDP. The value of imports was $132.1 billion, an increase of 14.2% over that of 1994. The value of exports was $148.8 billion, up 22.9% from that of 1994.

The Government announced that, beginning on April 1, 1996, China would lower tariffs on goods imported into China from an average of 35.9% to 23%. A list of 1,800 items to have lower tariffs was released detailing general items including minerals, metals, and other products. In the past, tariffs had been broken down into preferential tariffs for qualified businesses in the country's Special Economic Zones and nonpreferential tariffs. It is not yet clear whether the policy of allowing different tariffs on products from different companies and countries would continue as an amendment from under the new rules.[12]

The Ministry of Foreign Trade and Economic Corp. published new regulations on barter trade. According to the publication, all goods were open for barter trade except grain, tungsten ore, and crude oil and refinery products, which required approval for export. Import quotas would not be assigned to trading enterprises but import approval procedures and application for import licenses would be continued.

Commodity Review

Metals

Aluminum.—CNNC negotiated with Alcoa of Australia Ltd. to supply 600,000 t of alumina yearly for 5 years at an agreed c.i.f. price. Neither party commented on the agreed price. Chinese traders believed that the price was 10% to 20% below the spot market price. CNNC believed that the agreement would strengthen the country's imports and exports of nonferrous metals, which caused serious problems in the domestic nonferrous sector.[13]

CNNC and the People's Government of Guangxi Zhuangzu Zizhiqu joint-investment project, Guangxi Pingguo Aluminium Co. at Pingguo Xian, completed its first phase construction in 1995. In 1995, the company produced 37,661 t of alumina. Because of technical problems, the aluminum smelter had been operating at a 50% rate and shipped out 43,433 t of aluminum ingot in 1995. The construction of five bauxite mines was also completed. Initial output capacity would be 1.9 Mt of bauxite. The first phase construction site covered an area of 1,750 square kilometers (km^2) and contains bauxite reserves of 240 Mt.[14]

Kaiser Aluminum and Chemicals Corp. of the United States announced that the corporation formed an aluminum joint venture with CNNC. Under the agreement, CNNC and Kaiser would invest $121 million with a 51-49 equity to develop the aluminum industry in China. The joint venture was named as Huang He (Yellow River) Aluminium Co. Ltd. CNNC would contribute assets of two existing smelters—Lanzhou and Lainhai in Lanzhou Shi, Gansu Province—and Kaiser would invest $60 million and introduce advanced smelting technology and modern management style to the joint venture. Kaiser created a wholly owned subsidiary, Kaiser Yellow River Investment Ltd. to oversee the project. The $60-million investment from Kaiser would be used to upgrade the facilities at Lanzhou and to increase the output capacity at Lainhai from 30,000 t to 60,000 t.[15]

Alcan Aluminium Ltd. of Canada announced that the company signed a memorandum of understanding with CNNC to explore the possible construction of an aluminum smelter in Shanxi Province. The proposed smelter was expected to have an annual output capacity of 200,000 t to 240,000 t of primary aluminum metal. Alcan and CNNC planned to work jointly to develop a project prospectus for use in discussion with the Chinese government and with potential partners in the smelters.[16]

Aluminum Co. of America (Alcoa) and Shanghai Aluminium Fabrication Plant finalized an agreement for creating a joint venture, Alcoa Shanghai Aluminium Products Co., in Shanghai to produce up to 9,500 t of aluminum foil for packaging sectors. An existing foil-rolling facility in Shanghai would be operated by a joint venture owned 60% by Alcoa and 40% by Shanghai Aluminium Fabrication Plant. Of the required $30 million, Alcoa would contribute its share in both cash and technology assistance.[17]

The aluminum foil plant owned by Bohai Aluminum Industries began production in 1995. The plant had been idle for 4 years because of lack of operating software. The plant was designed by Davy McKee of the United Kingdom. The plant had an annual output capacity of 20,000 t.[18]

Qinghai Aluminium Smelter completed its second phase construction at yearend 1994. But, since then, it never reached its annual output capacity of 200,000 t because of inadequate electricity supply and technical problems. The smelter produced about 120,000 t aluminum in 1995 and was expected to reach its full capacity before the end of 1997.

Copper.—Guixi Smelter, operated by Jiangxi Copper Co. in Jiangxi Province received the Government approval for its second-phase expansion. The second-phase construction cost was expected to be 1.9 billion yuan ($229 million). After completion, annual output capacity of electrolytic copper was expected to increase from the current level of 86,000 metric tons per year (t/yr) to 200,000 t/yr. Most of the key equipment and technology will be obtained from other countries.

Tongling Nonferrous Metals Co. in Anhui Province, China; Sharpline International Ltd. in Hong Kong; and Japan's Sumitomo Metal Mining Co., Itochu Corp., and Sumitomo Corp. formed a joint venture to invest $200 million for the expansion of the Tongling copper smelter. Tongling and Sharpline, both subsidiaries of CNNC, accounted for a 65% of total investment. The new plant was scheduled to be in operation in 1997 and was expected to increase the company's annual output capacity by 100,000 t of copper.[19] Tongling copper mine would not have the capacity to provide the feed; therefore, some copper concentrates would be imported from Australia and Chile. Most of the production would be consumed in China, but some might be exported to Japan and Southeast Asian countries.

Shenyang Smelter Corp., a subsidiary of CNNC, closed down its aging copper refinery and replaced it with a new refinery that was outside the city in an economic development zone. The new refinery was a joint venture between Shenyang Smelter Corp. and the Hong Kong based Everwin International Group. The 100,000 t output capacity refinery came on-stream in the second half of 1995.[20]

CNNC assigned the Jiangxi Copper Co. in Jiangxi Province to take over the management responsibility for the Shanghai Smelter in Shanghai. In the last several years, Shanghai Smelter was operating under financial loss and a fall in production. In addition, the smelter used outmoded smelting technology and was in the center of Shanghai, causing a lot of environmental problems to the city. The smelter had an annual output capacity of 80,000 t of refined copper. However, because of the shortage of raw materials in China, Shanghai Smelter was required to import about one-third of its raw materials from other countries.[21]

London Metal Exchange (LME) brokers, including Crédit Lyonnais Rouse, Merrill Lynch, Lehman Brothers, and Prubache Securities, claimed that Citic's subsidiary, Citic Shanghai, owed them about $40 million on copper trade in 1994. The Government arrested four staff employees in Shanghai on corruption charges relating to unauthorized trading. According to Citic, no domestic subsidiary of Citic was permitted to acquire foreign credit from overseas except Citic Industrial Bank. Citic also claimed that, under the laws of China, Citic's Shanghai Branch is an independent legal entity and that the parent company should not be liable to pay the debt. However, the LME brokers insisted Citic Shanghai was a branch and was not a subsidiary of Citic. Negotiations on the settlement was reached in 1995.

Taicang Copper Co., a subsidiary of Shanghai Minmetals, decided to increase its refined copper output from 20,000 t to 40,000 t through the acquisition of two plants in Zhejiang Province. The newly acquired plants had outdated equipment. Taicang Copper Co. planned to replace them with new equipment that had an annual output capacity of 10,000 t of electrolytic copper in each plant. Minmetals imported nearly all raw materials for the refinery. Most of the production were sold in the domestic market.[22]

Gold.—According to the Gold Administration Bureau of MMI, China produced 90.2 t and 105 t of gold in 1994 and 1995, respectively. These were well below estimates by Western gold observers. In 1994, only 82 t of gold produced were sold to the PBC, even though PBC had the Government decrees to strictly monopolize the purchase and sales of gold. Shandong Province produced 26.8 t of gold in 1995.[23] In regards to geological prospecting, China had a total proven reserves of 4,500 t of gold.[24]

According to MMI, the western region would become the country's important gold production base in the next decade. The nine Provinces in the western region—Gansu, Guizhou, Ningxia, Shaanxi, Sichuan, Qinghai, Xinjiang, Xizang, and Yunnan—accounted for 22% of the country's total proven gold reserves. Scrambling to get rich, hundreds or perhaps thousands of gold hunters rushed to the west. Widespread illegal exploration and unregulated gold mining seriously damaged the environment in the region. Government authorities were concerned that the country's already degraded base of natural resources was also being depleted. Most of mined gold was traded illegally.

China had great potential as a gold producer and buyer, but the Government would not open its gold market until the renminbi became strong, confident, and stable. According to the World Gold Council, China was the world's fourth largest gold consumer in 1994 after India, the United States, and Japan. In 1994, the total gold consumption of China, Hong Kong, and Taiwan was 433.8 t, 20% of world demand.

In 1995, the State Planning Commission approved the agreement between Asia Minerals Corp. of Canada and Shandong Zhaoyuan City Gold Corp. of China to invest $35.2 million in the development of the Yingezhuang Mine in Shandong Province. A feasibility study indicated that the mine had ore reserves of 19.42 Mt at a grade of 2.82 gram of gold per t. According to Asia Minerals, the Yingezhuang Mine, which started up in 1992, had a capacity of 400 metric tons per day. In 1993, the mine produced 340 kilogram of gold from 140,000 t of ore, at a cost of $6.10 per gram. Gold occurs in a shear zone within an altered granite. The mineralogy was described as "simple" and recovery from flotation and cyanide leaching was 91% in 1993. A feasibility study proposed an increase of daily capacity to 2,000 t. In addition, more work was being required to evaluate its economic potential and define the mining reserves of the deposit. According to the agreement, Asia Minerals must finance $3.5 million on underground drilling, engineering, and design work to earn a 50% interest of the mine. Asia Minerals had also shown interest in developing the Lannigou Mine in southern Guizhou Province, which contained 45 t of gold.[25]

Iron and Steel.—Most of China's iron and steel enterprises experienced a very difficult financial situation. The price of raw materials and energy increased sharply in the past 2 years. The triangular debt situation among steel producers increased. The Government applied a mini-retrenchment plan in July 1993. The iron and steel enterprises owed billions of yuan since that time to coal suppliers and to electric powerplants. In order to continue providing coal and electricity to the steel plants, fuel and energy suppliers insisted that steel plants repaid their debts first. Therefore, some steel plants were forced to shut down their operation. Shoudu Iron and Steel Complex (Shougang) and Anshan Iron and Steel Corp. were partially shut down in 1995.

China planned to build a deepwater port at Majishan in eastern Zhejiang Province to handle 20 Mt of iron ore imports yearly. China was expected to import about 40% of its demand iron ore from Australia, Brazil, and South Africa by the year 2000. First-phase construction of the three berths would require a total investment of 2.27 billion yuan ($274 million).

Brazil's Companhia Vale do Rio Doce (CVRD) and MMI agreed to construct a new deepwater port in northern Brazil. Construction of a new port would reduce the cost of transporting ore across the country. MMI's agreement for port construction was one of the remaining obstacles to the proposed joint venture between CVRD and MMI to mine iron ore in Carajas, northern Brazil. The joint-venture project included installation of a new mining unit to expand the output capacity to 8 Mt/yr. CVRD planned to export 15 Mt of iron ore to China in 1996.

The Japanese government agreed to provide $142 million loan through the Export-Import Bank of China to the Baoshan Iron and Steel Complex (Baogang) for its third-phase expansion funds.[26] The third-phase expansion project was scheduled to be completed in 1998. With an additioned 4.3 Mt steelmaking capacity, Baogang will have an annual output capacity of 11.5 Mt of crude steel. The third-phase expansion focused on the production of hot- and cold-rolled steel sheet and strip, including tinplate, electrical sheet, hot-rolled steel for welded oil pipes, and plate for shipbuilding. Upon completion, Baogang's continuous casting capability was expected to increase from 60% to 90%. The No. 3 blast furnace with a designed capacity of 4,350 cubic meter (m^3) and an annual production capacity of 3.5 Mt of iron went into operation in September 1994. The total pig iron output capacity increased to 9.75 Mt/yr. The hot rolling mill was being supplied by Mitsubishi Heavy Industries. Clecim of France and Danieli of Italy won the contract to supply a 1.5 Mt/yr direct current electric furnace and a continuous caster to produce 980,000 t/yr of pierced billet. German's SMS Schloemann-Siemag, Mannesmann-Demag, and Siemens, Nippon Steel of Japan, and Littel of the United States would supply a 1,420-mm cold-rolled strip mill and tinning line. Baogang imported about 95% of its iron ore from Australia, Brazil, India, and South Africa.

After a management reorganization in February 1995, Shougang stopped its program to become a diversified multinational company by the year 2000. The corporation planned to focus its effort on developing its iron and steel business. The corporation abandoned its multibillion dollar plans to buy a privatized industrial group in Italy and an iron ore mine in Malaysia. In Hong Kong, Shougang sold one of its listed subsidiaries, Ho Sing Holdings, an unprofitable construction company. Scandals occurred in early 1995 that tarnished the reputation of the Shougang and sent Shougang shares into a free fall in the stock market in Hong Kong. Shougang's subsidiaries in Hong Kong had difficulties obtaining financing because of publicity. Shougang had to stop 10 ongoing construction projects in order to save funds for its daily operation.

Guangzhou Iron and Steel Co., Boulder Group, and Australian Overseas Resources signed a joint-venture agreement for constructing a stainless steel bar and wire rod plant in Guangzhou, Guangdong Province. The joint-venture group agreed on an initial target of 55,000 t/yr stainless steel bar. An expansion plan would increase the output capacity to 500,000 t/yr of stainless steel products. The mill would have the capability to produce 55,000 t/yr of stainless bars from 12 mm to 35 mm in diameter and wire rod from 5.5 mm to 8 mm in diameter. The mill would also be technically capable of producing structural shapes with minor equipment modifications. Initial investment was expected to be about $92 million. A ground-breaking for the new plant was held in December 1995, and it was expected to be commissioned in early 1998.

Posco of South Korea signed a letter of intent with China's

National Ferrous Metal Materials Corp. to establish a joint venture to construct and operate a 100,000-t/yr capacity galvanized sheet and coil plant in China. The aim of the joint venture was to help relieve the shortage of hot-dipped galvanized sheets and also to assist Posco in securing its cold-rolled coil market in China.[27]

In a second agreement, Posco and Tongsin Special Steel Co. agreed to build a 50,000-t/yr color-coated steel sheet plant in Jiangsu Province. Seventy percent of the steel sheet would be supplied to the domestic market, and the remainder would be exported to Southeast Asian countries. The plant would begin operation in March 1996.

Zunyi Ferro-Alloy Works formed a joint venture with the Hong Kong-based Glory Profit Co. for the purpose of operating one electric furnace with 50 megavolt ampere (MVA) to produce about 25,000 t/yr of silicomanganese. Zunyi Ferro-Alloy Works purchased three electric furnaces (two 50 MVA and one 31.5 MVA) from Mannesmann Demag of Germany several years ago. Because of a worldwide depression the ferroalloy market, the three electric furnaces remained idle for a long time. Also, when the operation of these three furnaces were to start operation, the company was required to pay back immediately the money that was borrowed from the Government. That would cause a heavy burden for the company; therefore, the company sought foreign investment to introduce funds for a modernization plan. The company was also to secure operating funds from a Japanese trading company to produce ferrosilicon from the other two furnaces.[28]

Kawasaki Steel Corp. of Japan signed an agreement with Fujian Toceka Tinplate Co. in Longhai Shi, Fujian Province, to supply an electrotinplating line with annual output capacity of 150,000 t. Fujian Teceka Tinplate Co. was a joint venture of Ton Yi Industrial Co. of Taiwan; China National Cereals, Oils, and Foodstuffs Import and Export Corp.; and Japan's Kawasaki Steel Corp., Kawasho Corp., and Tomen Corp. The total investment was to be about $100 million. Feedstock for the line would be supplied from Ton Yi's rolling mill in Taiwan.[29]

Lead and Zinc.—Construction of a 400-t/d lead and zinc ore dressing plant was completed in 1995, as part of the opencast Lanping lead and zinc mine, Yunnan Province. The mine had verified reserves of 14.3 Mt of lead and zinc. Apart from lead and zinc, the ore also contained cadmium, silver, and thallium.

Zhuzhou Smelter in Hunan Province became a member of the International Lead and Zinc Research Organization (Ilzro), a market research organization, in Research Triangle, North Carolina, in 1995. Zhuzhou considered Ilzro as a critical partner for assistance in its capacity expansion through technological modernization. Zhuzhou produced about 70,000 t of refined lead, 130,000 t of zinc slab, 10,000 t of copper, 4,000 t of cadmium, and 250 t of bismuth per year. The smelter planned to increase its zinc production capacity to 250,000 t of zinc in 1997.[30]

Shaoguan Smelter, a subsidiary of CNNC, in Guangdong Province, completed its 1.1 billion yuan expansion project in 1995. The project included the installation of two generators at the company's existing powerplant in a bid to meet increased power demand. The powerplant would supply 50% of its total electricity needs. The remaining 50% requirement would continue to be dependent on supply from the Province power network. As the result of expansion, Shaoguan increased its annual production capacity to 120,000 t of zinc and 60,000 t of lead.[31]

Magnesium.—Liaoning Magnesite and Refractories Corp., the largest magnesite company in China, was undergoing extensive restructuring in 1995. The corporation had four operating units—Liaoning Magnesite Plant, which had an annual output capacity of 50,000 t of high-grade dead-burned magnesia; the Qinhuayu Kilns Mine; Huaeziqu Kilns Mine; and Dashiqiao refractories plant. The four units would probably be managed by four separate entities.

A Japanese consortium, including Ube Industries (38%), Kanematsu Corp. (16%), and Mitsui and Co. (16%), agreed to form a joint venture, Nanjing Ube Magnesium Co., with Nanjing Huahong (30%) in Nanjing Shi, Jiangsu Province. A new 3,300 t/yr capacity plant would be constructed at the existing Nanjing Huahong plant site. A 700-t/yr furnace from Nanjing Huahong would be transferred to the new joint venture, giving a total annual output capacity of 4,000 t. Nanjing Huahong's dolomite mine would supply raw material to the new plant; while Ube would provide Pidgeon process technology, quality control, and management. The new plant was expected to start production in fall 1995. Each investor would take output according to its investment shares.[32]

Nickel.—Jinchuan Nonferrous Metals Corp. is the largest nickel and cobalt producer in China. Its annual output accounts for more than 80% of the country's total output. The cost of the second-phase expansion was about $270 million and was completed at the end of 1994. Technical difficulties slowed the company's plan to increase nickel annual production capacity to 40,000 t.

Rare Earths.—China's State Planning Commission planned to increase its annual rare-earth ores production from its current 40,000 t to 55,000 t in 2000. Rare-earth oxide was to increase from 25,000 t in 1995 to 40,000 t in 2000. Domestic rare-earth consumption accounted for less than one-half of the country's production. The remainder was exported. Of the exports, about one-half was shipped to Japan, 30% to the United States, and 20% to Europe. Domestic rare-earth consumption by share was metallurgical sector, 43%; petrochemical sector, 28%; agriculture, 15%; glass/ceramic sector, 10%; and magnets/phosphors, 4%.

Tin.—The Chinese Government decided to control the export of tin ingot by issuing licenses for the export of 15,000 t and the export of tin concentrates was prohibited. Strict measures were taken to control the outward smuggling.

However, according to Hong Kong traders, some Chinese companies were still exporting tin concentrates. The Yunnan Tin Corp., the largest tin producer in China, planned to produce 20,000 mt of tin ingots in 1995. Because of uncontrolled tin concentrates exports, the corporation planned to import tin concentrates to make tin ingots.[33]

Tungsten.—China Huaxing Tungsten Corp. (also known as CNNC Nanchang Corp.) and China's Hong Kong based Shangxing Minmetals Ltd. agreed to set up a joint venture, Sinotungsten Ltd., to export Chinese tungsten products. The joint venture planned to seek financial assistance to upgrade technology at Chinese tungsten mines and plants.

Domestic tungsten mines were still suffering from increased financial burdens because of new taxes imposed on mining industry. Production costs went up more than 200%, and nonproductive mines were closed during the past several years. All state-owned tungsten mines in Jiangxi, Hunan, and Guangdong were shut down for about 2 months in 1995 to carry out mine repairs and maintenance. Western analysts believed that the 2-month moratorium was principally aimed at improving price.

Other Metals and Minerals.—Eastern Asia Metal Investment Co. Ltd., a subsidiary of state-owned China Iron and Steel Industry and Trade Group Corp., Jilin Ferroalloy Works, and Northern Transvaal Development Corp. formed a $70-million joint venture, Asia South Africa Metals Proprietary Ltd., to run the Dilokong chrome mine in South Africa. The joint venture also planned to build a 100,000-t/yr smelter near the mine.

Tioxide, a subsidiary of Imperial Chemical Industries of the United Kingdom, signed a memorandum of understanding with Chongqing-Hong Kong Titanium White Ltd. to take a 51% share in a titanium dioxide (TiO_2) plant in Chongqing, Sichuan Province. The 15,000-t TiO_2 plant used sulfate technology acquired from Poland and began operation in 1995. In the agreement, the production capacity of the Chongqing plant would be expanded to 25,000 t/yr by the end of 1997, and capacity would be doubled by the end of the decade.[34]

Toyo Engineering Corp. and Marubeni Corp. of Japan were awarded by Technical Progress Corp. the right to construct an 800-t/d diammonium phosphate (DAP) plant at Luzhai, Guangxi Province. The DAP plant was part of the Luzhai Fertilizer project that included a 60,000-t/yr ammonia plant and a 1,200-t/d sulphuric acid plant. The project was partly financed by a loan from the Overseas Economic Cooperative Fund of Japan. The project was scheduled for completion in June 1997 using Espindesa technology.[35]

Mineral Fuels

The development of the power industry in China was impressive in the past several years. However, China's power industry remained under pressure to catch up with the country's double-digit economic growth. The energy supply by share was of coal, 74.4%; crude oil and gas, 19%; hydropower, 4.6%: and nuclear, less than 0.05%. The Chinese power industry was expected to increase its power generating capacity to 300,000 megawatt (MW) by the year 2000. To achieve this goal, the Government was encouraging various forms of cooperation, including export credit granted by foreign governments, issuance of bonds and stocks, and joint-venture investments with foreign investors. An official from the Ministry of Power Industry indicated that energy development priority would go to hydroelectric projects, coal-fired plants, and long-distance power transmission projects.

In recent years, there was a sharp increase of electricity consumption and the electricity shortage intensified especially in the coastal regions. The Government set up a new electricity pricing system to ease the shortage of electricity. In 1995, the North China Power Group that supplies electricity to Beijing, Tianjin, and Hebei Province increased electricity prices and charged different fees for commercial consumers in different time zones in this area.

According to an official of the Ministry of Power Industry, China planned to build more than 10 nuclear powerplants in the next 20 years. By 2020, total nuclear power installed capacity was planned to be 20 gigawatts in China, accounting for 6% of total electricity supply. China had two commercial nuclear powerplants in operation—Qinshan in Zhejiang Province and Daya Wan in Guangdong Province. The Government designated feasibility studies for nuclear powerplants in the Provinces of Fujian, Hainan, Heilongjiang, Jiangsu, Jiangxi, Jilin, Liaoning, Shandong, Sichuan, and Zhejiang.

In October 1995, Atomic Energy of Canada Ltd. and China National Nuclear Corp. signed an agreement that Canada would sell two 700-MW Candu-6 reactors to China. The $2.6 billion nuclear reactors would be in Qinshan. The Candu-6 reactor uses natural uranium and heavy water for cooling. Technical and commercial negotiations for the project began in late 1995.

With the Government approval, the China National Nuclear Corp. established the Liaoning Nuclear Power Co. Ltd. to negotiate with Russia to build a nuclear powerplant at Wafangdian in Liaoning Province. The first-phase $3.2-billion plant would have two Russian WWER-1000 1,000-MW pressurized reactors that would be financed partly through state loans from the Russian Government. Preparatory work was underway at the site.[36]

Coal.—Despite a relaxation in the control of coal prices by the Government and a massive rearrangement of industry workers over the past several years, coal enterprises remained over-staffed with an overall low level of efficiency because of nonmechanical operations. China had more than 100 state-owned coal enterprises. Only about 20 were making profit, and others were operating in the red. The Government offered 3 billion yuan ($361 million) in discount financial loans to assist them to overcome their difficulties. One-third of this amount was to be set aside for settling consequential problems following the closure of obsolete coal mines. Even with Government assistance, coal enterprises still had difficulties in resolving problems that they inherited in the planned system.

The Government implemented a sale contract system between coal producers and consumers in 1995. Bothsides settled coal prices through negotiation. All contracts would be properly honored and implemented. Violators would be fined. This move was a countermeasure against the deferral payment used by coal consumers. In 1994, the country's unpaid coal bill was more than $1.2 billion. However, the Government maintained exclusive rights to buy an unspecified amount of coal to support the power, metallurgical, and fertilizer sectors.

China produced 1,298 Mt of different kinds of coal in 1995. China consumed about 1,300 Mt of coal. Most coal was used by the power, chemical, and metallurgical sectors. The amount used in rail transport and households was continuously decreasing. The stockpile of coal was estimated at about 200 Mt. Consumption was expected to continue to grow faster than output in the next several years. Higher demand and sustained growth in coal exports would reduce the amount on hand and push coal prices higher. The demand for providing high-quality coal would hardly be eased, especially in the coastal Provinces. Guangdong Province proposed banning new coal-fired powerplants in the Zhuhai region because of severe sulfur dioxide pollution. All existing powerplants were required to upgrade antipollution equipment. Coal mines were generally in the interior Provinces, while the big coal consumers were along the coast. Transportation difficulties were often delayed the shipment of coal to where it was needed. Higher costs encouraged coastal Provinces to buy from abroad.

According to the General Administration of Customs of China, China exported 28.6 Mt of coal and 8.86 Mt of coke in 1995. The Government planned to export a total of 40 Mt of coal and coke in 1996. The Chinese Ministry of Foreign Trade and Economic Corp. and the State Administration for the Inspection of Import and Export Commodities jointly promulgated provisional regulations on controlling coke export that would be put on effect on January 1, 1996, to control the export quality and to ensure that all coke exports under the quota were allotted. The China Chamber of Commerce for Metals, Minerals, and Chemicals Imports and Exports was assigned the task for coordinating and controlling coke export. All trading corporations, industry-trade corporations, and production enterprises engaged in export would have to be under the coordination and management of the Chamber of Commerce.[37]

China planned to adopt new policies to allow direct foreign investment in the coal sector through joint venture and holding companies. Before this, only Government loans and compensation trade were available to foreigners. As part of a new strategy to attract foreign investment in the coal sector in China, the Government planned to offer a variety of inducements, which included speedy approval of foreign-funded projects, permission to create solely foreign-funded companies in all fields except the mining of coking coal, and priority in access to domestic funds.[38]

China was rich in coalbed methane. Based on an estimation by the Government statistical department, China had about 35 trillion m^3 within the depth of 2,000 meters (m). Drainage of coalbed methane might result in mine fires and waste valuable energy resources. Mine explosions, collapses, and other accidents involved more than 10,000 miners across China each year. The Government sought foreign investment and technology to develop and use coalbed methane to cut pollution and mining accidents. China planned to adopt a series of preferential policies toward coal gas exploitation projects, including suspension of coal gas-related energy compensation charges, and reduction and exemption of coal gas sales tax.[39]

Petroleum.—China continued to make progress in its efforts to boost oil and gas reserves and increase production. The petroleum sector was struggling to keep up with rocketing domestic oil and gas demand paced by one of the world's fastest growing economies. China's crude oil production increased at a rate of 1% per year in the past several years, while crude oil demand grew more than 5% per year during the same period. China became a net oil importer in 1995. According to the General Administration of Customs of China, China exported 18.8 Mt of crude oil while importing 17.1 Mt, and exported 4.15 Mt of refined petroleum products while the imports of refined petroleum products increased to 14.39 Mt. Petroleum analysts in China predicted that the demand would exceed production by about 10 Mt of crude oil in 1996. This would mean that there would be more oil imports in 1996. In 1995, the output of gasoline reached about 29 Mt and diesel was about 38 Mt. In 1996, gasoline and diesel production would increase to 31 Mt and 40 Mt, respectively. China was expecting a shortfall of about 2 Mt of gasoline and 6 Mt of diesel in 1996. The growth in use of motor vehicles was increasing dramatically and showed little sign of slowing down.

China relied on onshore fields for most of its oil, accounting for 95% of the country's total output. The biggest producers were in the northeast, and production in this region was dwindling after decades of steady output. The anticipated offshore boom was slower than expected. The first- and second-round oil bidding in the Tarim Basin, Xinjiang Zizhiqu were disappointing especially in the second-round. Domestic and foreign exploration and production companies had high hopes for the Tarim Basin. However, because of two-thirds of the basin was covered by the Taklimakan Desert, costs were estimated in the millions of dollars just to establish sufficient infrastructure to get to and from the sites. In addition, the weather in the region was very harsh and did not support human access.

The Chinese Government announced a third-round bidding in Xinjiang Zhzhiqu in June 1995. The Areas covered 113,000 km^2 in the Tarim and Junggar basins. Eight blocks were in the southern and northwestern parts of the Tarim Basin and the other four blocks were in the Junggar Basin.

According to an official from the China National Petroleum Corp. (CNPC), Chinese companies had obtained commercial flows of oil and natural gas from wells in areas surrounding the blocks. Exploration in these areas would be more encouraging than the other two-round bids in previous years.

The Ministry of Finance announced amendments on reducing some of the royalty fees it charged in order to make onshore oil areas more attractive to foreign explorers. If annual output for each field was under 1 Mt of crude oil and 2 billion m^3 of gas, there would be no royalty payments for companies exploiting oil and gas in Qinghai Province, Xinjiang Zizhiqu, Xizang Zizhiqu, and in the shallow waters on the Continental Shelf. Under the original provisions of the rules, explorers were required to pay 6.4% royalty. Fields producing between 1 Mt and 1.5 Mt would pay 4% royalty. Royalties for foreign cooperative oil and gasfields in other provinces and regions also were cut by 6%. The maximum royalty would be 12.5% for an oil field with annual production of more than 4 Mt. The purpose of these substantial cuts in royalties was to encourage the development of small- and medium-sized oilfields and gasfields.[40]

China faced heavy pressure to balance the surplus oil available in the north and the shortage of oil in the south. The Government believed that policies posted in the early 1994 would improve the supply and demand balance of the north-south oil supply gap in China. However, according to an official from Sinochem, the fundamental problem remained unchanged. Southern end-users do not want to be restricted to buying only northern products. Even with the addition of taxes, the cost of imported oil is cheaper in the domestic market.

China and Vietnam agreed to negotiate the dispute on the Spratly Islands in Nan Hai (South China Sea). The two sides considered joint exploration for oil reserves in that region.

The Chinese Government approved the proposed study on importing natural gas from central Asian nations and the eastern part of Siberia in the next 5 years. Natural gas would be transported and distributed by nationwide pipelines. In 1995, the output of natural gas was 17 billion m^3 in China. China had natural gas resources at about 33 trillion m^3. Of this, 1.14 trillion m^3 had been confirmed. China would concentrate its effort on gas exploration in high-potential areas—Gansu, Ningxi, Shaanxi, Sichuan, and Xinjiang.

China was moving to liberalize its oil sector. However, full deregulation would take several years to implement. China had a two-tier oil price system where 80% of its crude oil prices was fixed at 700 yuan/t ($84/t) and 20% at 1,200 yuan/t ($145/t). According to an official from the Planning Commission, the oil sector would continue its management strategy and policies to ensure deeper reforms and to open wider to world access. But the country would delay domestic oil and product prices to float freely with international market level.[41]

CNPC signed an agreement with Amoco of the United States to explore natural gas in the Qaidam Basin in Qinghai Province. According to the agreement, Amoco would carry out 6 months of exploration and evaluation in an area of 21,000 km^2 in the eastern part of the basin and had rights to develop it. Chinese geologists predicted the area contained up to 1 trillion m^3 of natural gas.[42]

Offshore drilling in China resulted in mixed results for foreign explorers. Arco China Inc., a subsidiary of Atlantic Richfield Co. in the United States, abandoned Yacheng 35-1-2 in Nan Hai, which was proven a dry hole. But the Yacheng 13-1 field, jointly developed by state-owned China National Offshore Oil Corp. (Cnooc), Arco China Inc., and Kuwait Foreign Petroleum Exploration Co., located 90 km off Hainan Province, was expected to supply natural gas through a 775-kilometer-long undersea pipeline to Hong Kong by January 1, 1996. Arco agreed to form a joint venture with Cnooc to develop Dongfang 1-1 gasfield in Nan Hai. XCL, formerly known as the Exploration Co. of Louisiana, worked on the Zhaodong C-1 appraisal well in Bo Hai. Zhaodong C-1 flowed 2,160 barrels of oil in 1995. The well was operated by XCL and Apache Corp. of Houston. The state-owned China National Oil and Gas Exploration and Development Corp. had the right to a 51% share ownership if it proved commercial. XCL and Apache planned to spend at least $18 million to expand the project.

China's oil refining sector was undergoing a major overhaul. New refineries were being built and existing ones were being upgraded and expanded. Most of the new construction was in the southern and coastal regions of China. The country's crude-distillation capacity would be sufficient, but secondary units remained far short of demand.

Germany-based BASF proposed forming a joint venture with Sinopec Yangzi Petrochemical Corp. to build a $4-billion petrochemical complex in Nanjing, Jiangsu Province. The project would have a 600,000 t/yr ethylene cracker and facilities for other downstream products. Building the complex would require importing as much as $2 billion worth of equipment.[43]

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[1] Where necessary, values have been converted from renminbi (RMB) to U.S. dollars at the rate of RMB8.30 yuan=US$1.00 for 1995.

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Major Sources of Information

China National Nonferrous Metals Industry Corp.
12B Fuxing Lu, Beijing 100814

China National Offshore Oil Corp.
1A Sidaskou Lu, Dazhongshi Nau, Haidianqu, Beijing 100086

China National Petroleum Corp.
Liupukang, Beijing 100724

China National Offshore Oil Corp.
Jingwin Building 2A, Donsanhuan Beilu, Beijing 100027

China Non-metallic Minerals Industry Corp.
Bai Wan Zhuang, Beijing

Ministry of Chemical Industry
Building 16, Hepingli Qiqu, Dongcheng District, Beijing 100013

Ministry of Coal Industry
21 Hepingli Bei Lu, Beijing 100713

Ministry of Foreign Trade and Economic Corp.
2 Dong Chang'anjie, Dongcheng District, Beijing 100731

Ministry of Geology and Mineral Resources
64 Funei Dajie, Beijing 100812

Ministry of Metallurgical Industry
46 Dongsi Xi Dajie, Beijing 100711

Ministry of Power Industry
137 Fuyoujie, Xicheng District, Beijing 100031

National Environmental Protection Agency
115 Xizhimennei Nanxiaojie, Xicheng District, Beijing 100035

People's Bank of China
410 Fuchengmen Dajie, Beijing 100034

Major Publications

Almanac of China's Economy, annual.

Beijing Review, 24, Baiwanzhuang Road, Beijing 100037, China.

China's Customs Statistics, Economic Information and Agency, Hong Kong, 342, Hennessy Road, 10th floor, Hong Kong.

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TABLE 1
CHINA: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
METALS						
Aluminum:						
Bauxite, gross weight	thousand tons	2,600	2,700	3,500	3,700	5,000
Alumina, gross weight	do.	1,520	1,580	1,820	1,850 r/	2,200
Metal, refined, primary and secondary	do.	963	1,100	1,260	1,500 r/	1,660
Antimony:						
Mine, Sb content		58,300	59,400	60,000	91,000 r/	75,000
Metal		61,400	68,100	81,300	101,200 r/	91,200
Bismuth:						
Mine output, Bi content		1,040	820	740	610 r/	700
Metal		1,270	1,060	1,050	850 r/	1,100
Cadmium, smelter		1,200	1,150	1,160	1,280 r/	1,200
Cobalt:						
Mine output, Co content		230	260	240	270	300
Metal		300	220	190	200	210
Copper:						
Mine output, Cu content		304,000	334,200	345,000	395,600 r/	400,000
Metal:						
Smelter, primary		385,000	418,000	443,000	482,400 r/	490,000
Refined, primary and secondary		560,000	659,000	733,000 r/	736,100 r/	843,000
Gold, mine output, Au content		120	125 r/	130 r/	132 r/	140
Iron and steel:						
Iron ore, gross weight	thousand tons	176,070	197,600	234,660	240,170	249,350
Pig iron	do.	6,770 r/	7,590 r/	8,740 r/	97,410 r/	101,700
Ferroalloys	do.	2,460	2,650	3,000	3,360 r/	3,150
Steel, crude	do.	70,570	80,940 r/	89,560 r/	92,610 r/	92,970
Steel, rolled	do.	56,380	66,970 r/	77,160 r/	84,280 r/	79,390
Lead:						
Mine output, Pb content		352,000	330,200	338,100	461,900 r/	430,000
Metal:						
Smelter, primary		270,000	295,000	326,000	408,000 r/	365,000
Refined, primary and secondary		330,000	365,000	412,000	467,900 r/	420,000
Magnesium metal, primary		8,600	10,550	11,800	24,000 r/	27,000
Manganese ore, gross weight	thousand tons	5,150	5,300	5,860	3,570 r/	5,000
Mercury, mine output, Hg content		760	580	520	470 r/	540
Molybdenum, mine output, Mo content		13,200	19,200	18,300	21,400 r/	20,000
Nickel:						
Mine output, Ni content		30,400	32,800	30,700	36,900 r/	37,000
Matte		31,900	36,100	34,600	37,200 r/	36,000
Smelter		28,900	30,800	30,500	31,300 r/	38,000
Silver, mine output, Ag content		150	170	200	210	250
Tin:						
Mine output, Sn content		42,100	43,800	49,100	54,100 r/	52,000
Metal, smelter		36,400	39,600	52,100	67,800 r/	60,700
Titanium		1,820	1,710	1,490	850	1,320
Tungsten, mine output, W content		31,800	25,410	21,600	27,000 r/	21,000

See footnotes at end of table.

TABLE 1--Continued
CHINA: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
METALS--Continued						
Zinc:						
Mine output, Zn content		750,000	758,100	775,000	990,300 r/	950,000
Refined, primary and secondary		612,000	719,000	857,000	1,012,000 r/	1,054,000
INDUSTRIAL MINERALS						
Asbestos		200,000	225,900 r/	242,600 r/	240,000	240,000
Barite	thousand tons	1,600	1,500	1,500	1,500	1,500
Boron, mine, B_2O_3 equivalent		92,500	126,800	155,400 r/	188,200 r/	180,000
Bromine		12,100	16,650	24,600 r/	31,400 r/	30,000
Cement, hydraulic	thousand tons	252,610	308,220	367,880	421,180 r/	445,610
Fluorspar	do.	1,920	1,890	2,050	900 r/	1,000
Graphite		289,000	300,000	310,000	360,000	350,000
Gypsum	thousand tons	10,500	11,000	10,600	10,500	11,000
Kyanite and related materials		2,500	2,500	2,500	2,500	2,500
Lithium minerals, all types		15,500	15,500	15,500	16,000 r/	16,000
Magnesite	thousand tons	1,650	1,510	1,230	990 r/	1,000
Nitrogen: N content of ammonia	do.	18,100	19,000	18,000	19,000	19,500
Phosphate rock and apatite, P_2O_5 equivalent	do.	6,500	6,400 r/	6,350 r/	7,400 r/	7,000
Potash, marketable, K_2O equivalent	do.	32	21	25	26 r/	25
Salt	do.	24,100	28,100	29,530	29,746	24,990
Sodium compounds: Soda ash, natural and synthetic	do.	3,940	4,550 r/	5,350 r/	5,810 r/	5,740
Sulfur:						
Native	do.	320	320	330	330	330
Content of pyrite	do.	4,940	4,930 r/	5,330 r/	5,870 r/	5,500
Byproduct, all sources	do.	650	650	700	700	700
Total	do.	5,910	5,900 r/	6,360 r/	6,900 r/	6,530
Talc and related materials	do.	2,600	2,500	2,300	2,400	2,400
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite	do.	214,370	214,000	220,000	230,000	260,000
Bituminous and lignite	do.	875,630	896,000	920,000	980,000	1,038,000
Total	do.	1,090,000	1,110,000	1,140,000	1,210,000	1,298,000
Coke, all types	do.	73,520	79,840	93,200	114,770 r/	72,700
Gas, natural:						
Gross	billion cubic meters	16	16	17	17	17
Marketed	do.	13	14	15	15	15
Petroleum:						
Crude (including crude from oil shale)	million 42-gallon barrels	1,015	1,050	1,060	1,080	1,100
Refinery products	do.	800	830	860	950	950

e/ Estimated. r/ Revised.

1/ Table includes data available through Apr. 15, 1996.

TABLE 2
CHINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies 1/	Location of main facilities	Annual capacity e/
Aluminum:			
Alumina	Pingguo Aluminum Industry Co.	Guangxi, Pingguo	300
Do.	Guizhou Aluminum Plant	Guizhou, Guiyang	400
Do.	Changcheng (Great Wall) Aluminum Corp.	Henan, Zhongzhou	200
Do.	do.	Hunan, Zhengzhou	640
Do.	Shandong Aluminum Plant	Shandong, Zibo	500
Do.	Shanxi Aluminum Plant	Shanxi, Hejin	1,200
Metal	Hefei Aluminum Plant	Anhui, Hefei	25
Do.	Baiyin Aluminum Plant	Gansu, Baiyin	50
Do.	Huang He Aluminum Corp.	Gansu, Lanzhou	82
Do.	Liancheng Aluminum Plant	do.	85
Do.	Pingguo Aluminum Industry Co.	Guangxi, Pingguo	100
Do.	Guizhou Aluminum Plant	Guizhou, Guiyang	160
Do.	Changcheng (Great Wall) Aluminum Corp.	Hunan, Zhengzhou	32
Do.	Fushun Aluminum Plant	Liaoning, Fushun	100
Do.	Qingtongxia Aluminum Plant	Ningxia, Qingtongxia	82
Do.	Qinghai Aluminum Smelter	Qinghai, Xining	200
Do.	Shandong Aluminum Plant	Shandong, Zibo	35
Do.	Jiaozuo Aluminum Plant	Henan, Jiaozuo	33
Do.	Sanmenxia Aluminum Plant	Henan, Sanmenxia	30
Do.	Yanji Aluminum Plant	Jilin, Yanji	15
Do.	Baotou Aluminum Plant	Nei Mongol, Baotou	70
Do.	Tongchuan Aluminum Plant	Shaanix, Tongchuan	35
Do.	Taiyuan Aluminum Plant	Shanxi, Taiyuan	15
Do.	Yunnan Aluminum Plant	Yunnan, Kunming	15
Asbestos	China National Nonmetallic Minerals Industry Corp.	Nei Mongol, Baotou; Shanxi, Lai Yuan and Lu Liang	130
Barite	do.	Guizhou, Xiangshou	NA
Coal	Ministry of Coal Industry	Hebei	70,000
Do.	do.	Heilongjiang	100,000
Do.	do.	Henan	100,000
Do.	do.	Liaoning	70,000
Do.	do.	Nei Mongol	90,000
Do.	do.	Shandong	60,000
Do.	do.	Shanxi	400,000
Do.	do.	Sichuan	80,000
Cobalt tons	Jinchuan Nonferrous Metals Corp.	Gansu, Jinchang	400
Copper, refined	Tongling Nonferrous Metals Co.	Anhui, Tongling	30
Do.	Wuhu Smelter	Anhui, Wuhu	45
Do.	Baiyin Nonferrous Metals Co.	Gansu, Baiyin	50
Do.	Jinchuan Nonferrous Metals Corp.	Gansu, Jinchuan	20
Do.	Daye Nonferrous Metals Co.	Hubei, Daye	20
Do.	Zhuzhou Smelter	Hunan, Zhuzhou	10
Do.	Jiangxi Copper Metals Co.	Jiangxi, Guixi	86
Do.	Huludao Zinc Smelting Co.	Liaoning, Huludao	60
Do.	Shenyang Smelter	Liaoning, Shenyang	100
Do.	Shanghai Smelter	Shanghai	80
Do.	Taiyuan Copper Industry Co.	Shanxi, Taiyuan	25
Do.	Tianjin Copper Electrolysis Factory	Tianjin	25
Do.	Yunnan Smelter	Yunnan, Kunming	95
Gas, natural billion cubic meters	China National Petroleum Corp.	Sichuan	10
Gold, refined thousand kilograms	China National Gold Corp.	Henan, Lingbu	3
Do.	Laizhou Gold Co.	Shandong, Laizhou	15
Do.	Zhaoyuan Gold Co.	Shandong, Zhaoyuan	6

See footnotes at end of table.

TABLE 2--Continued
CHINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies 1/	Location of main facilities	Annual capacity e/
Graphite	China National Nonmetallic Industry Corp.	Shandong, Laixi and Pingdu	190
Iron and steel:			
Iron ore	Maanshan Iron and Steel Co.	Anhui, Maanshan	10,000
Do.	Shoudu Iron and Steel Co.	Beijing	20,000
Do.	Meishan Metallurgical Co.	Shanghai	2,000
Do.	Jiuquan Iron and Steel Co.	Gansu, Jiayuguan	4,000
Do.	Hainan Iron Mine	Hainan, Changjiang	4,600
Do.	Handan Xingtai Metallurgical Bureau	Hebei, Handan	3,800
Do.	Tangshan Iron and Steel Co.	Hebei, Tangshan	3,000
Do.	Wuhan Iron and Steel Co.	Hubei, Wuhan	5,100
Do.	Banshigou Iron Mine Mining Co.	Jilin, Hunjiang	1,400
Do.	Anshan Iron and Steel Co.	Liaoning, Anshan	30,000
Do.	Benxi Iron and Steel Co.	Liaoning, Benxi	13,700
Do.	Baotou Iron and Steel Co.	Nei Mongol, Boatou	10,000
Do.	Taiyuan Iron and Steel Co.	Shanxi, Taiyuan	4,000
Do.	Dabaoshan Mining Co.	Guangdong, Qujiang	1,670
Do.	Panzhihua Mining Co.	Sichuan, Panzhihua	13,000
Do.	Kuming Iron and Steel Co.	Yunnan, Kuming	1,400
Ferroalloy	Shoudu Iron and Steel Co.	Beijing	35
Do.	Northwest Ferroalloy Co.	Gansu, Yongdeng	60
Do.	Zunyi Ferroalloy Co.	Guizhou, Zunhi	100
Do.	Jilin Ferroalloy Co.	Jilin, Jilin	250
Do.	Jinzhou Ferroalloy Co.	Liaoning, Jinzhou	90
Do.	Liaoyang Ferroalloy Co.	Liaoning, Liaoyang	70
Do.	Shanghai Steel Co.	Shanghai	180
Do.	Emi Ferroalloy Co.	Sichuan, Emei	70
Do.	Hengshan Ferroalloy Co.	Zhejiang, Jiande	70
Crude steel	Maanshan Iron and Steel Co.	Anhui, Maanshan	2,500
Do.	Shoudu Iron and Steel Co.	Beijing	10,000
Do.	Tangshan Iron and Steel Co.	Hebei, Tangshan	2,000
Do.	Wuhan Iron and Steel Co.	Hubei, Wuhan	6,000
Do.	Anshan Iron an Steel Co.	Liaoning, Anshan	10,000
Do.	Benxi Iron and Steel Co.	Liaoning, Benxi	2,700
Do.	Baotou Iron and Steel Co.	Nei Monggol, Baotou	3,500
Do.	Baoshan Iron and Steel Co.	Shanghai	10,000
Do.	Shanghai Steel Co.	do.	6,000
Do.	Taiyuan Iron and Steel Co. No. 2.	Shanxi, Taiyuan	2,500
Do.	Panzhihua Iron and Steel Co.	Sichuan, Panzhihua	2,500
Do.	Tianjin Iron and Steel Co.	Tianjin	2,000
Lead	Baiyin Nonferrous Metals Co.	Gansu, Baiyin	50
Do.	Shaoguan Smelter	Guangdong, Shaoquan	30
Do.	Shuikoushan Mining Bureau	Hunan, Hengyang	30
Do.	Zhuzhou Smelter	Hunan, Zhuzhou	80
Do.	Shenyang Smelter	Liaoning, Shenyang	70
Do.	Kunming Smelter	Yunnan, Kunming	20
Nickel, refined	Jinchuan Nonferrous Metals Corp.	Gansu, Jinchuan	40
Do.	Chengdu Electro-Metallurgy Factory	Sichuan, Chengdu	3
Magnesium	Fushun Aluminum Plant	Liaoning, Fushun	5
Do.	Minhe Magnesium Plant	Qinghai, Minhe	4
Petroleum, crude	Shengli Bureau	Hebei, Shengli	33,350
Do.	Daqing Bureau	Heilongjiang, Daqing	55,000
Do.	Liaohe Bureau	Liaoning, Liaohe	15,000
Do.	Bohai Offshore Oil Corp.	Bohai	4,000
Do.	Nanhai East Corp.	Nanhai	5,000

See footnotes at end of table.

TABLE 2--Continued
CHINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies 1/	Location of main facilities	Annual capacity e/
Potash	Ministry of Chemical Industry	Qinghai	40
Rare earths	Gansu Rare Earths Co.	Gansu, Baiyin	12
Do.	Jiangxi Rare Earths Co.	Jiangxi, Nanchang	1
Do.	Zhujiang Refinery	Guangdong, Guangzhou	5
Do.	Baotou Iron and Steel and Rare Earths Corp.	Nei Mongol, Baotou	12
Salt	Ministry of Chemical Industry	Anhui	200
Do.	do.	Qinghai	320
Talc	China National Nonmetallic Industry Corp.	Guangxi, Longshen	130
Do.	do.	Liaoning, Haicheng	50
Do.	do.	Shandong, Qixia	5
Tin, smelter	Dachang Mining Administration	Guangxi, Dachang	5
Do.	Yunnan Tin Industry Co.	Yunnan, Gejiu	15
Titanium	Zunyi Titanium Plant	Guizhou, Zunyi	5
Do.	Fushun Aluminum Plant	Liaoning, Fushun	1
Tungsten, concentrate	China National Nonferrous Metals Industry Corp.	Guangdong, Guangxi, Hunan, Jiangxi, and Zhejiang	60
Zinc	Baiyin Nonferrous Metals Co.	Gansu, Baiyan	100
Do.	Shaoquan Smelter	Guangdong, Shaoquan	70
Do.	Liuzhou Zinc Products Factory	Guangxi, Liuzhou	22
Do.	Shuikoushan Mining Bureau	Hunan, Hengyan	28
Do.	Zhuzhou Smelter	Hunan, Zhuzhou	140
Do.	Huludao Zinc Smelting Co.	Liaoning, Huludao	180
Do.	Shenyang Smelter	Liaoning, Shenyang	20

e/ Estimated. NA Not available.

1/ Companies are owned either by State Government or Provincial Government

TABLE 3
CHINA: EXPORTS OF SELECTED MINERAL COMMODITIES IN 1995

(Metric tons)

	Quantity	Value (thousands)
METALS		
Aluminum:		
Bauxite	450,000	$23,971
Alumina	10,000	3,508
Metal and alloys:		
Unwrought	191,310	327,621
Semimanufactures	65,436	126,028
Antimony metal, unwrought	25,464	73,177
Barium sulfate	1,200,000	35,904
Copper, metal and alloys:		
Unwrought	43,048	114,116
Semimanufactures	87,344	300,233
Iron and steel:		
Ferrosilicon	390,000	211,694
Pig iron and cast iron	5,390,000	805,732
Steel:		
Bars and rods	820,000	268,166
Shapes and sections	460,000	143,451
Sheets and plates	3,790,000	1,355,535
Tube and pipe	270,000	240,551
Magnessium carbonate and oxide	2,310,000	324,623
Manganese, unwrought	50,250	77,176
Tin, metal and alloys, unwrought	43,307	236,247
Tungsten:		
Tungstates	17,731	121,473
Ore	260	929
Zinc:		
Metal and alloys, unwrought	191,535	179,390
Oxide and peroxide	39,824	34,749
INDUSTRIAL MINERALS		
Cement	8,190,000	298,066
Fluorspar	1,230,000	113,776
Graphite, natural	193,647	50,377
Talc	1,590,000	83,206
MINERAL FUELS		
Coal	28,620,000	1,010,684
Coke, semicoke	8,860,000	682,924
Petroleum:		
Crude oil	18,850,000	2,238,801
Refinery products	4,150,000	792,240

Source: China's Customs Statistics (1995.12)

TABLE 4
CHINA: IMPORTS OF SELECTED MINERAL COMMODITIES IN 1995

(Metric tons)

	Quantity	Value (thousands)
METALS		
Aluminum:		
Alumina	1,190,000	$258,118
Metal and alloys, unwrought	387,926	513,896
Semimanufactures	287,826	575,238
Scrap	357,198	149,158
Chromium: Chromite	1,380,000	202,317
Copper:		
Ore	480,000	298,944
Metal and alloys, unwrought	187,504	406,441
Semimanufactures	350,393	949,960
Scrap	1,188,926	492,600
Iron and steel:		
Iron ore	41,150,000	1,226,912
Pig iron and cast iron	80,000	11,044
Steel:		
Bars and rods	4,680,000	1,381,694
Seamless pipe	920,000	899,718
Shapes and sections	530,000	257,624
Sheets and plates	7,430,000	3,791,612
Manganese ore	1,290,000	105,085
INDUSTRIAL MINERALS		
Diamond kilograms	662	135,176
Fertilizers:		
Compound fertilizers	7,300,000	1,616,783
Potassium chloride	3,860,000	437,795
Potassium sulfate	440,000	89,872
Sodium carbonate	75,324	12,564
Urea	6,860,000	1,426,975
Titanium doxide	53,445	47,861
MINERAL FUELS		
Coal	1,610,000	70,531
Petroleum:		
Crude oil	17,090,000	2,356,427
Refinery products	14,390,000	2,065,463

Source: China's Customs Statistics (1995.12)

THE MINERAL INDUSTRY OF

FIJI

By Travis Q. Lyday

Metallic mineralization was widespread in Fiji, occurring as polymetallic base metal sulfide deposits, disseminated porphyry copper deposits, epithermal precious-metal deposits, residual bauxite deposits, and manganese and heavy-mineral sand deposits. However, gold along with associated silver was the only mineralization mined during 1995. Fiji's mineral industry also consisted of a cement plant next to the harbor at Suva, and several quarries for the production of stone and crushed gravel, limestone, and coral and river sands. The cement plant was opened in 1961 by Fiji Industries Ltd. and, until 1993 when cement production was begun at Lae in Papua New Guinea, was the region's only producer.

Although gold has been produced in Fiji since shortly after its discovery, the only significant mines have been the Emperor Mine and the Tavua Basin Mine, both owned and operated by the Emperor Gold Mining Co. Ltd. (EGM). The Emperor Mine is adjacent to the town of Vatukoula, meaning "Rock of Gold," about 100 kilometers (km) northwest of the capital at Suva and eight km inland from the coast, in the Nakauvadra Mountains at the northern tip of the main island of Viti Levu. The Tavua Basin Mine is inland from the coastal town of Tavua, about 2.5 km south of the Emperor Mine. The Emperor Mine has been in continuous production since 1935, while production from the Tavua Basin Mine began in 1987. Both mines also produced byproduct silver. The Emperor Mine also recovered until 1980 significant amounts of selenium and tellurium oxides from the ore.

EGM announced an increase of 39% in its gold resources, to a total of about 106 metric tons (mt), in the third quarter of the year. The previous figure was about 75 mt.

Because of the exhaustion of the open pit resources in 1992, and the subsequent return to mining exclusively underground, the underground workings at the Emperor Mine have expanded immensely. With increasing heat conditions at the lower levels preventing mining activities from progressing deeper, in conjunction with the existing ventilation capacity already operating nearly at full capacity, EGM began construction at yearend of a new ventilation shaft in order to open up deeper levels of the operation to mining. The new shaft will have a 2-lift configuration, with a 60-m horizontal offset between them. The upper shaft will descend from the surface to level eight (209-m) and the lower shaft will extend from level eight to level 16 (529-m).

Sydney, Australia-based Placer Pacific Ltd.'s local subsidiary, Placer Pacific Namosi Ltd., and the Government reached agreement at yearend on a range of issues relating to Placer Pacific's Namosi low-grade porphyry copper-gold prospect. Namosi is about 30 km northwest of Suva, 20 km from the coast. Placer Pacific and its predecessors have delineated 930 million metric tons (Mmt) of measured resources grading 0.43% copper and 0.14 gram per mt gold using a cut off grade of 0.3% copper since 1991. Although the resource is large, it remained sub-economic primarily due to the low grades of copper and gold. The agreement provided a fiscal regime that will bestow the best opportunity for exploration and assessment leading eventually to mine development. The agreement related to various concerns, including import duties, royalties, depreciation, and taxation.

Mount Kasi Ltd., a wholly owned subsidiary of Australia's Pacific Islands Gold NL, began production late in the year at its Mount Kasi gold project at Savusavu near the Yanawai River on the south coast of Vanua Levu, Fiji's second-largest island. Initial production was to be about 1,000 kilograms per year (kg/a) of gold; this was to increase to about 1,500 kg/a within the first three years of the mine's 9-year life. Reportedly, however, the project had the potential to continue for 20 years. It was at the Mount Kasi site that gold was first found in Fiji, in 1929. Production at Mount Kasi began in the early 1930's, continuing until the mine was closed in mid-1943.

Major Source of Information

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TABLE 1
FIJI: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
Cement, hydraulic		78,800	84,400	79,500	93,600 r/	78,200
Gold, mine output, Au content	kilograms	2,743	3,701	3,784	3,440	3,775
Silver, mine output, Ag content	do.	477	1,258	1,112	1,386	1,765
Stone, sand and gravel:						
Coral sand for cement manufacture		71,664	61,465	65,303	66,939	70,000
River sand for cement manufacture		19,386	20,000 e/	13,186	15,000 e/	15,000
River sand and gravel, n.e.s.	cubic meters	800,000 e/	73,395	426,880	148,049	200,000
Quarried stone	do.	73,771	63,412	84,670	63,154	70,000

e/ Estimated. r/ Revised.

1/ Table includes data available through Apr. 2, 1996.

THE MINERAL INDUSTRY OF

INDIA

By Travis Q. Lyday

India, a republic consisting of 25 States and 7 union territories, was endowed with a large work force, including persons skilled in all areas of the minerals industry.

Under India's Constitution, the exploration and production of most minerals fell within the jurisdiction of the central Government. Accordingly, the mineral industry of India primarily was owned and administered by the Government, either directly or through public-sector endeavors, and most mining companies were nationalized.

The country was fairly rich in minerals. Its deposits of bauxite, copper, iron ore, and manganese were some of the largest in the world. Most of these deposits were in the south and central highlands of the country. The total value of all minerals produced in India represented about 3% of the country's gross domestic product, estimated to be about $252 billion[1] in Indian fiscal year 1995-96.[2]

India was a major minerals producer, ranking among the world's leading producers of bauxite, bituminous coal, iron ore, and zinc ore. Its main mining industry was the production of steaming coal for power generation p-1 . Coal provided an estimated two-thirds of the country's energy requirements. Including peat and lignite, it accounted for an estimated 40% of the value of all mineral production. Iron ore, primarily from surface operations, accounted for an estimated 40% of the value of all metallic mineral production. Approximately 50% was used domestically for steel production and the balance was exported.

Domestic production of copper, lead, and zinc satisfied less than about 45% of the country's requirements, with imports fulfilling the balance. Aluminum was the only nonferrous metal for which an adequate domestic ore (bauxite) resource was available.

Limestone for steel and cement production remained the leader in the industrial minerals sector, producing an estimated 70% of the total value of industrial minerals.

The central Government introduced in midyear restrictions and prohibitions on expansion, modernization, or startup of new projects in any part of the country, unless environmental clearance previously had been bestowed. All major projects were required to submit an environmental impact assessment as well as an environmental management plan prior to the granting of environmental clearance.

Mining in India was regulated under the Mines and Minerals (Regulation and Development) Act, 1957, as modified. Under this Act, all minerals were owned by the constituent States, but were administered by the central Government. Mining royalties and taxes, although set and revised by the central Government, were paid directly to the individual States.

The mining industry was administered by the Ministry of Mines, which was responsible for geological surveys, exploration, and administration of the Mines and Minerals Act for all minerals except mineral fuels. Coal was administered by the Department of Coal within the Ministry of Energy. The Ministry of Petroleum and Natural Gas had responsibility for exploration and production of oil and natural gas, as well as its refining, distribution, and marketing. Nuclear materials were regulated by the Department of Atomic Energy (DAE). The Geological Survey of India, the Indian Bureau of Mines, and the Controller of Mining Leases were subordinate offices within the Ministry of Mines.

The minerals industry of India produced about 70 mineral commodities embracing various ores, metals, industrial minerals, and mineral fuels. An estimated 4,400 mines operated in the country, the vast majority of which were small surface operations using only hand-mining methods and having low output. About 300 underground mines were in production in the nonfuel minerals sector, most of which also were operated manually.

Employment in the minerals industry was estimated to exceed 1 million, or about 4.5% of the employed labor force, with the public sector employing about 90% of the total.

India had a sizable, integrated aluminum industry based on domestic bauxite deposits, which were estimated to comprise about 10% of the world's total. Aluminum remained the sole nonferrous metal for which India had an adequate raw material base.

Hindalco Industries Ltd. implemented during the year two expansions at its Renukoot Smelter in Uttar Pradesh, first increasing capacity 20,000 metric tons per year (t/yr) from 170,000 t/yr, and then achieving an additional 30,000 t/yr of capacity near yearend, for a total of 210,000 t/yr.

Indian Aluminium Co. Ltd. (INDAL) postponed its plans to install a 700-megawatt (MW) powerplant at its Belgaum aluminum smelter in the southern State of Karnataka. The smelter was closed in 1992 as a result of a 36% increase in the cost of energy supplied by the State Government, but was reopened in 1994 at reduced capacity in response to the worldwide rise in aluminum prices. The smelter's output in 1994 was only 18,000 t/yr of aluminum, and INDAL does not consider an increase in the capacity of the plant to be a viable option.

Some of the equipment from the Belgaum Smelter was transferred to INDAL's smelter at Hirakud in Orissa State, where capacity was expanded to 30,000 t/yr.

More than one-half of India's chrome ore mines were in the districts of Cuttack, Dhenkanal, and Keonjhar in Orissa State, while the others were distributed relatively evenly among the States of Andhra Pradesh, Bihar, Karnataka, Maharashtra, and Manipur. The major chromite mining companies were Tata Iron and Steel Co. Ltd. (TISCO), Orissa Mining Corp. Ltd. (OMC), Ferro Alloys Corp. Ltd., Mysore Minerals Ltd., and Indian Metals and Ferro Alloys Ltd.

A dispute between TISCO and OMC over access to reserves in Orissa State resulted in litigation during the year. TISCO sought to renew its chromite ore mining lease, covering 1,261 hectares (ha), in Orissa's Sukinda Valley in 1992 after holding that lease for 20 years. However, the High Court of Orissa State awarded only about one-third (406 ha) to the original lessee, TISCO, and the remaining approximately two-thirds (855 ha) to OMC. TISCO has appealed the decision to India's Supreme Court.

India's State-owned Hindustan Copper Ltd. (HCL) produced the majority of the country's mined copper from 10 mines. HCL also operated the country's copper smelters and refineries. Important, but smaller, mines were operated by Sikkim Mining Corp. and Hutti Gold Mines in Karnataka State. More than 90% of India's copper ore reserves were in the States of Bihar, Madhya Pradesh, and Rajasthan.

The Kerala State Industrial Development Corp. signed a memorandum of understanding (MOU) with Kochi-based Kerala Copper and Chemicals Ltd. (KCCL) to construct a greenfield copper refining plant for the production of 5,000 t/yr of copper cathode using secondary raw materials such as copper dross and ashes as feed. KCCL had a technology transfer agreement with U.S.-based Mountain States Research and Development International for the extraction of copper using the latest solvent extraction-electrowinning technology. Australia's Allied Ventures reportedly would be an important supplier of copper scrap.

The first phase of KCCL's project was scheduled to be ready for commercial production in July 1996. In a second phase, KCCL was proposing to establish an integrated smelting facility for treating copper concentrates.

Master Alloys Ltd. planned to install a 40,000-t/yr copper refinery and smelter near Pondicherry, 200 kilometers (km) from Madras in southern India. The copper complex was to begin operating in June 1997. The company was considering using either the Ausmelt, Outokumpu, or Boliden technology, but would not be making the decision until early 1996.

Although India was one of the world's largest consumers of gold, spurred by the Government's 1992 decision to permit nonresident Indians to bring into the country up to 5 kilograms of gold per person for a nominal duty (22 rupees or about $0.64 per gram), domestic production has waned profoundly in recent years, and the country was only producing about 2 t/yr. About one-half was produced by the activities of numerous small-scale miners, mainly unorganized independent prospectors.

Government-owned Bharat Gold Mines Ltd. mined gold from a number of mines in the Kolar Goldfields, Karnataka State, one of the oldest gold mining areas in the world. Production from the Kolar fields began in 1882. A small amount of gold also was produced as a byproduct of copper refining.

The Government approved in November a joint-venture agreement between the ailing Bharat Gold Mines and Singapore-based Normandy Anglo Asian Pvt. Ltd. for exploration of gold from shallow mining operations. The equity participation had not been decided by yearend, however. The joint venture formed part of the rehabilitation program developed for the company by the Industrial Credit and Investment Corp. of India under a directive issued by the Board for Industrial and Financial Reconstruction. Additionally, the Indian Government was selling the tailings owned by the loss-producing company from which the easily recovered gold had already been extracted. The Government was going to sell to bidders from Australia, Canada, and the United States who have developed the technology to extract more of the remaining gold.

India was a major producer of iron ore, which was used to produce steel for domestic use as well as for export by two State-owned enterprises, the National Mineral Development Corp. Ltd. (NMDC) and the Kudremukh Iron Ore Co. Ltd. (KIOCL). Numerous iron ore mines in the country had an estimated combined capacity of 60 million metric tons per year (Mt/yr).

The country has abundant deposits of hematite and magnetite iron ores. Hematite occurs mostly in the States of Bihar, Goa, Karnataka, Madhya Pradesh, Maharashtra, and Orissa. Magnetite deposits, most being of metallurgical grade, occur in Andhra Pradesh, Goa, Karnataka, and Kerala States. Madhya Pradesh was the leading producing State in 1995, with Goa, Karnataka, Bihar, Orissa, and Maharashtra following in order.

NMDC operated the country's largest mechanized iron mines at Bailadila, Madhya Pradesh State, and at Donimalai, Karnataka State. Output from the two mines was about 9 Mt/yr, but output was scheduled to be doubled by March 1997. KIOCL operated the country's largest single mine, the Kudremukh, 110 km east of the southern port city of Mangalore in Karnataka State.

The country had seven integrated steel plants (ISP) and numerous scrap-based minimills with a combined capacity of about 24 Mt/yr. The Government's Steel Authority of India Ltd. (SAIL) owned five ISP, namely Bhilai ISP, Madhya Pradesh State; Bokaro ISP, Bihar State; Durgapur ISP, West Bengal State; Rourkela ISP, Orissa State; and Burnpur ISP, West Bengal State, the steelworks operated since 1979 by Indian Iron and Steel Co. Ltd., a wholly owned subsidiary of SAIL. The Visakhapatnam ISP, Andhra Pradesh State, owned and operated by the public-sector corporation Rashtriya Ispat Nigam Ltd. (Vizag), was commissioned near yearend 1989. The only privately owned ISP in India, the steelworks at Jamshedpur, Bihar State, was operated by TISCO.

The Government announced at yearend its plans to abolish the Engineering Goods Export Assistance Fund, which was financed by about a $9 per ton levy on products from the main steel producers. Between $5 and $6 million have been collected monthly through this levy, about 60% of it from SAIL and the rest from TISCO and Vizag. The mills were expected to benefit from revocation of the fund, either by leaving the net sales price unchanged after the levy was revoked so as to increase profit margin, or by reducing prices to stimulate higher sales.

Substantial quantities of lead and zinc were produced from the same mines in the State of Rajasthan by HZL, the country's sole producer of both metals. HZL also mined lead without zinc in the States of Andhra Pradesh and Orissa. HZL operated the country's three primary lead and three of the four primary zinc smelter-refinery complexes; the remaining primary smelter-refinery was operated by Binani Zinc Ltd., producing zinc from imported concentrates.

The private-sector Indian Lead Pvt. Ltd. produced secondary lead from indigenous and imported lead scrap and lead concentrates at plants at Phane, Maharashtra State, and Kalipara, West Bengal State.

The Government-owned Manganese Ore (India) Ltd. announced at yearend its plans to initiate a major modernization program at its Balaghat Mine in Madhya Pradesh State. Reportedly the deepest manganese mine in the world, Balaghat has reached a depth of 240 meters in 8 levels; a 9th level was under development.

The Atomic Minerals Div. within the DAE was responsible for conducting radiometric and geological surveys and for the exploration and development of various mineral resources necessary for the country's nuclear power program.

The Uranium Corp. of India Ltd. (UCIL) within the DAE operated uranium mines at Jaduguda and Bhatin; a uranium mill at Jaduguda; and uranium recovery plants at Mosaboni, Rakha, and Surda, all in Bihar State. UCIL also had the capability of recovering other metals and minerals as byproducts, such as copper, magnetite, and molybdenite.

Cement production capacity has risen dramatically since the early 1980's, from about 26 Mt to more than 75 Mt, following price and distribution decontrol. Most of the new capacity, about 69 Mt, was derived from large-scale, highly efficient, predominantly privately owned plants. India's cement industry recently has become the fifth largest in the world after China, the United States, Japan, and the Commonwealth of Independent States.

Calcutta-based KHSL Industries Ltd., a maker of refractory raw materials, announced in July that it would purchase a 63.5-MW powerplant from South Africa to power a cement joint venture. The plant was originally set up by the Italian company Ansaldo Energia SpA. in a segregated black South African homeland, but before the plant could be commissioned, the first multiracial elections were held in South Africa, thereby making the plant superfluous to that country's surplus of power, even though the black homelands themselves were energy deficient. KHSL was to pay $60 million for the unused, secondhand plant, which reportedly was ideally suited for Indian usage in that it could operate using coal with up to a 47% ash content. India's cement industry was dependent entirely on coal, including lignite as a supplement in the southern regions of the country, as the fuel for its kilns.

The NMDC produced most of the country's modest diamond output from its diamondiferous kimberlite mines at Wajrakarur, Andhra Pradesh. A small quantity of diamond also was produced in Orissa State.

India's diamond industry, the world's largest in terms of employment, quantity, and value, primarily was dependent on imported materials for processing and reexport. India processed an estimated 65% of the world's rough diamonds and had about 45% of the world trade in finished diamonds, mainly small stones for use in lower priced jewelry. The majority of the cutting and polishing plants were in Bombay, Maharashtra State, and Surat, Gujarat State, receiving their imported material predominantly from de Beers' Central Selling Organization in the United Kingdom.

Australia's Renison Goldfields Consolidated Ltd. (RGC) signed in February a MOU with Indian participants Chemicals and Plastics India Ltd. (Chemplast), Indian Rare Earths Ltd. (IRE), and Kerala Minerals and Metals Ltd., a Government of Kerala (GOK) state enterprise, to evaluate a mineral sands project about 90 km north of the city of Trivandrum, Kerala, on India's southwest coast. The participants will be looking at the feasibility of developing a mineral sands and synthetic rutile project in the State. The initial equity in the proposed joint venture was to be shared equally between IRE-GOK, as one entity, RGC, and Chemplast. Project estimates indicated there was sufficient ilmenite feed for a synthetic rutile plant to produce 120,000 t/yr for a minimum of 15 years.

Canada's QIT-Fer et Titane (QIT) was negotiating with the Indian Government and IRE for an equity share in IRE's Orissa Sands Complex (OSCOM) in Orissa State to increase the rate of ilmenite production at OSCOM to provide ilmenite feedstock suitable for making chloride-grade slag at QIT's smelting facilities at Sorel in Canada. Final details were not known by yearend.

Rama Phosphates Ltd. (RPL) announced in midyear plans to build a new 400-metric-ton-per-day (t/d) single super phosphate (SSP) plant in Udaipur, Rajasthan State. The new plant was estimated to cost $3.8 million, and was scheduled to come on-stream early in 1996. Plans for the new unit also included a second expansion phase, raising capacity to 600 t/d.

RPL used phosphate rock from Rajasthan State Mines and Minerals Ltd. (RSMM) at its 132,000 t/yr SSP Indore plant in Madhya Pradesh. RSMM also was to supply the new plant at Udaipur; the finished product was to be marketed in the States of Gujarat, Madhya Pradesh, and Rajasthan. RPL merged in October 1994 with Krishi Rasayan Ltd., which operated a 120,000 t/yr SSP plant at Pune, Maharastra. As a condition of the merger, RPL agreed to expand the plant at Pune to a capacity of 144,000 t/yr; this expansion was in progress during the year.

Kutch Minerals Ltd., operating in the china clay, fireclay, and silica sand extraction and processing industry, announced early in the year plans to expand and modernize its existing projects in Manfara Village, in Kutch, India. Kutch Minerals was planning to expand its china clay production capacity from 10,000 t/yr to 30,000 t/yr, as well as set up facilities for the production of 90,000 t/yr of silica sand.

Coal was India's principal source of commercial energy, producing an estimated two-thirds of the country's requirements, almost all of which was produced domestically. The Government-owned Coal India Ltd. (CIL) was the country's largest producer, with about 90% of output, and also was responsible for administering all coal exploration and distribution programs. The bulk of production was from opencast mines; underground mines provided for less than 30% of production, but accounted for more than 65% of CIL personnel involved in mining. Coal mining in the private sector was permitted only for captive consumption by steel plants. However, the coking properties of Indian coals were poor because of a very high ash content and low calorific value; therefore, metallurgical-grade coals were imported, primarily from Australia. India's coal industry in 1995 was the fifth largest in the world.

Indian coals were ranked as either bituminous or lignite, the country having no anthracite deposits. The main bituminous coalfields are in the central and eastern States of Bihar, Madhya Pradesh, Orissa, and West Bengal. The lignite deposits are predominantly in the southern part of the country. About 80% of the country's known lignite occurs in Tamil Nadu State, with deposits also known in the States of Gujarat, Kerala, Rajasthan, and Jammu and Kashmir. The central Government-owned Neyveli Lignite Corp. (NLC) was the country's sole producer. In addition to the mines, the NLC integrated complex consisted of two thermal power stations, a fertilizer plant, and a briquetting and carbonization plant.

The central Government initiated a judicial investigation following serious coal mining accidents causing the deaths of numerous miners during torrential rains in late September and early October. The miners were believed to have drowned, or to have been buried by collapsing walls and roofs, in Bharat Coking Coal Ltd.'s Ajalgunj and Chaitudih Mines in the eastern State of Bihar when flood waters from the Gaslitand River filled the underground tunnels. Bharat, a wholly owned subsidiary of CIL, immediately suspended operations at its 92 mines until adequate safety measures were achieved.

CIL was seeking $500 million in direct funding from the World Bank and a similar sum in cofunding from Japan's Export-Import Bank to increase production by more than 40 Mt/yr in a program to develop or improve 33 mines. The new developments included South Eastern Coalfields Ltd.'s underground operations at Bangwar, Bhrabandh, Churcha West, Kurja, Pandavpara, Piparia, Singhali, and Somna; Mahanadi Coalfields Ltd.'s mines at Lakhanpur and Samleswari; and Central Coalfields Ltd.'s Parej East.

The Nuclear Power Corp. of India Ltd., under the auspices of the DAE, operated nuclear power stations at five sites within India, as follows: 1. Tarapur Atomic Power Station Units I and II, each having the capacity of generating 160 MW, at Tarapur, Maharashtra State. 2. Rajasthan Atomic Power Station Unit I having a capacity of 100 MW and Unit II with a capacity 200 MW, at Rawatbhata, near Kota in Rajasthan State. 3. Madras Atomic Power Station Units I and II, each having the capacity of generating 220 MW, at Kalpakkam near Madras in Tamil Nadu State. 4. Narora Atomic Power Station Units I and II, each having the capacity of generating 220 MW, at Narora in Uttar Pradesh State. 5. Kakrapar Atomic Power Station Unit I having a capacity of 220 MW at Kakrapar in Gujarat State; the station's Unit II, also of 220 MW capacity, was nearing the commissioning phase process at yearend.

Also, four units at two stations having 220 MW capacities at each unit also were nearing their commissioning processes. Additionally, the construction work at two units that each will have 220 MW of capacity was in progress at Kaiga, Karnataka State, as were two additional units at the Rawatbhata, Rajasthan State site, each also to have 220 MW of generating capacity.

The central Government administered the petroleum and natural gas industry of the country from exploration to the marketing of refined petroleum products until 1994 when the industry began to open up as part of the country's economic reforms initiated in 1991. Two State-owned companies, Oil and Natural Gas Corp. Ltd. and Oil India Ltd., conducted exploration for hydrocarbons and developed suitable discoveries for production until the Indian Cabinet early in the year cleared the way for foreign companies to conduct joint oil and gas exploration programs, both onshore and offshore, with the two Government enterprises. Six fundamentally Government-owned companies operated the country's petroleum refineries; they were all wholly owned Government entities until joint ventures were allowed to be forged in 1994. Imports and exports of crude oil and refined petroleum products were managed by Indian Oil Corp., the largest of the refining companies. Crude petroleum provided about 30% of the country's energy needs, with about 60% of this derived from imported stocks.

Construction of eight oil refineries by local companies was begun early in the year in an effort to more than double India's refining capacity by the end of the century. This does not include export-oriented refinery projects, nor those by foreign firms such as Malaysia's Petronas or the Royal Dutch/Shell Group, which were pursuing separate proposals. The last Indian refinery to be commissioned was a unit for the Indian Oil Corp. in 1982.

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[1] Where necessary, values have been converted from Indian rupees (Rs) to U.S. dollars at the rate of Rs34.29=US$1.00.

[2] The Indian fiscal year begins on Apr. 1 and ends on Mar. 31.

Major Sources of Information

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TABLE 1
INDIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
METALS						
Aluminum:						
Bauxite, gross weight	thousand tons	4,735	4,898	5,227 r/	4,809 r/	4,800
Alumina, Al_2O_3 equivalent e/	do.	1,700	1,700	1,800	2,000	2,000
Metal, primary		504,000	496,300	466,423	472,000 r/	463,200
Cadmium metal		271	313	255	216 r/	251 3/
Chromium: Chromite, gross weight		939,597	1,158,050 r/	1,026,024 r/	1,021,846 r/	1,230,000
Copper:						
Mine output, Cu content		50,430 r/	49,036 r/	49,416 r/	45,944 r/	63,000
Metal, primary:						
Smelter		45,531 r/	47,712	37,372	51,232 r/	48,600
Refinery						
Electrolytic (cathode)		38,600 r/	38,300 r/	30,100 r/	40,100 r/	32,200 3/
Fire refined		8,600 r/	8,500 r/	6,700 r/	8,900 r/	7,300 3/
Total		47,200 r/	46,800 r/	36,800 r/	49,000 r/	39,500 3/
Gold metal, smelter	kilograms	1,973	1,762	2,003	2,244 r/	2,300
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	56,880	54,870	57,375 r/	58,388 r/	59,000
Fe content	do.	36,403	35,117	36,720 r/	37,368 r/	37,800
Metal:						
Pig iron	do.	14,176	15,126	15,674	17,808 r/	18,626 3/
Direct-reduced iron	do.	1,153 r/	1,437 r/	2,208	3,122 r/	4,280 3/
Ferroalloys:						
Ferrochromium (including charge chrome)		229,477	256,831	234,500	251,459	300,000
Ferrochromiumsilicon e/		8,800 /3	9,000	8,000	8,000	9,000
Ferromanganese e/		211,000	198,000	137,291 3/	150,000	150,000
Ferrosilicon		85,300	90,000	67,600	85,000 e/	85,000
Silicomanganese e/		70,000	93,000	85,000 3/	90,000	90,000
Other e/		6,767 3/	6,500	8,600	8,500	8,500
Steel, crude	thousand tons	17,100	18,117	18,155	19,285 r/	20,291 3/
Semimanufactures e/ 4/	do.	11,600	12,000	9,000	11,000	11,000
Lead:						
Mine output, Pb content		25,068	30,500	26,000	30,500 r/	28,500 3/
Metal, refined:						
Primary e/		30,600	40,800	32,500 r/	38,600 r/	34,600
Secondary e/		17,200	22,900	18,200 r/	21,700 r/	19,500
Total		47,800	63,700	50,700 r/	60,300 r/	54,100 3/
Manganese:						
Ore and concentrate, gross weight	thousand tons	1,401	1,810	1,655	1,632 r/	1,650
Mn content e/	do.	532	687	628	620 r/	627

See footnotes at end of table.

TABLE 1--Continued
INDIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1991	1992	1993	1994	1995 e/
METALS--Continued					
Rare-earth metals: Monazite concentrate, gross weight e/	4,000	4,000	4,600	4,600	5,000
Selenium e/ kilograms	4,000	9,700	13,500	14,000	15,000
Silver, mine and smelter output do.	31,758	47,371	51,228	50,305 r/	39,800
Titanium concentrates, gross weight:					
Ilmenite e/	311,537 3/	300,000	320,000	300,000	300,000
Rutile e/	13,635 3/	10,000	13,900	14,000	14,000
Tungsten, mine output, W content	11	2 r/	1	2 r/	2
Zinc:					
Mine output, concentrate:					
Gross weight	163,474	300,140 r/	300,736 r/	270,382 r/	288,700
Zn content	104,500	152,800	156,300	147,300 r/	157,300 3/
Metal:					
Primary	83,600 r/	128,100	141,700	156,400 r/	146,500 3/
Secondary e/	200	200	200	500	500
Total e/	83,800 r/	128,300	141,900	156,900 r/	147,000
Zirconium concentrate: Zircon, gross weight e/	18,200	18,000	17,000	18,000	18,000
INDUSTRIAL MINERALS					
Abrasives, natural, n.e.s.:					
Corundum, natural	64	22 r/	15 r/	11 r/	10
Garnet	8,984	16,573 r/	47,785 r/	55,623 r/	55,000
Jasper	5,013	4,422 r/	5,627 r/	4,577 r/	5,000
Asbestos	24,094	43,683	44,080 r/	28,869 r/	30,000
Barite	615,000	458,436	547,875 r/	566,393 r/	575,000
Bromine, elemental e/	1,300	1,300	1,400	1,400	1,500
Cement, hydraulic e/ thousand tons	51,000	50,000	53,812 3/	54,000	55,000
Chalk	128,424	104,833 r/	98,966 r/	109,928	110,000
Clays:					
Ball clay	316,522	227,585	336,880	349,986 r/	350,000
Diaspore	9,248	10,393 r/	12,197	9,463 r/	10,000
Fireclay	403,000	458,674 r/	439,950 r/	397,435 r/	400,000
Kaolin:					
Salable crude thousand tons	628	514 r/	519	548 r/	550
Processed do.	113	124 r/	129	134 r/	150
Total do.	741	638 r/	648	682 r/	700
Other do.	14 e/	42 r/	40 r/	50 r/	50
Diamond:					
Gem e/ thousand carats	15	15	13 r/	15	13
Industrial e/ do.	3	3	7 r/	3	7
Total do.	18	18	20 r/	18	20
Feldspar	65,089	67,743	66,792 r/	65,001 r/	65,000
Fluorspar:					
Concentrates:					
Acid-grade	9,700	7,062	7.798	6,112 r/	8.000
Metallurgical-grade	14,439	13,572	13,846	15,783 r/	15,000
Total	24,139	20,634	21,644	21,895 r/	23,000
Other fluorspar materials, graded	8,218	2,666	4,782 r/	3,415 r/	4,000
Gemstones excluding diamond:					
Agate including chalcedony pebble	549	674 r/	680	641 r/	700
Garnet kilograms	1,187	616 r/	1,058	533 r/	750
Graphite 5/	69,922	72,996	82,398 r/	91,271 r/	90,000
Gypsum	1,553,000	1,300,868	1,804,661	1,675,830 r/	1,600,000
Kyanite and related materials:					
Kyanite	30,020	10,101	11,600 r/	6,262 r/	10,000
Sillimanite	11,600	18,837	15,563 r/	9,962 r/	15,000
Lime e/	820,000	850,000	860,000	860,000	900,000
Magnesite	539,000 e/	602,506	408,971	333,368 r/	400,000
Mica: 6/					
Crude	3,607	2,742 r/	2,082	2,041 r/	2,100
Scrap and waste	1,922	1,522 r/	1,187 r/	703 r/	900
Total	5,529	4,264 r/	3,269 r/	2,744 r/	3,000
Nitrogen: N content of ammonia thousand tons	7,132	7,452	7,176 r/	7,334 r/	7,713 3/

See footnotes at end of table.

TABLE 1--Continued
INDIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
INDUSTRIAL MINERALS--Continued						
Phosphate rock including apatite		610,100	487,824 r/	969,385 r/	1,176,451	1,250,000
Pigments, mineral: Natural: Ocher		155,563	142,478 r/	138,210 r/	157,900 r/	160,000
Pyrites, gross weight		128,000	134,522 r/	116,930	117,033 r/	120,000
Salt: e/						
Rock salt	thousand tons	3	3 3/	3 3/	3	3
Other	do.	9,500	9,500	9,500	9,500	9,500
Total	do.	9,503	9,503	9,503	9,503	9,503
Sodium carbonate e/		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Stone, sand and gravel:						
Calcite		98,236	67,185 r/	69,804 r/	66,480 r/	70,000
Dolomite	thousand tons	2,568	2,905 r/	3,498	3,105 r/	3,000
Limestone	do.	71,021	75,173 r/	82,095 r/	86,199 r/	90,000
Quartz and quartzite	do.	251	290 r/	248 r/	224 r/	250
Sand:						
Calcareous	do.	117	71 r/	272	183 r/	150
Silica	do.	1,924	1,316	1,148 r/	1,246 r/	1,300
Other	do.	1,652	1,316 r/	1,540 r/	1,700 r/	2,000
Slate		23,578	15,282 r/	12,134 r/	7,319 r/	8,000
Sulfur:						
Content of pyrites e/		30,000	30,000	36,000	38,000	40,000
Byproduct:						
From metallurgical plants e/		92,000	116,000	123,000	177,000 r/	200,000
From oil refineries		26,000	26,000	31,000	36,000 e/	35,000
Total e/		148,000	172,000	190,000	251,000 r/	275,000
Talc and related materials:						
Pyrophyllite		84,557	79,197 r/	82,269 r/	86,160 r/	86,000
Steatite (soapstone)		424,000 e/	368,003 r/	385,121 r/	371,580 r/	370,000
Vermiculite		1,768	1,609	1,485 r/	1,789 r/	1,800
Wollastonite		61,358	57,998 r/	80,748 r/	78,648 r/	80,000
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Bituminous	thousand tons	229,280	233,883 r/	246,041 r/	252,293 r/	255,000
Lignite	do.	15,970	16,114 r/	17,086 r/	18,936 r/	20,000
Total	do.	245,250	249,997 r/	263,127 r/	271,229 r/	275,000
Coke: e/						
Coke oven and beehive	do.	13,000	13,000	13,000	14,000	14,000
Gashouse	do.	100	100	100	100	100
Other, soft	do.	200	200	200	200	200
Total	do.	13,300	13,300	13,300	14,300	14,300
Gas, natural:						
Gross	million cubic meters	11,532	15,917	16,283 r/	15,293 r/	16,000
Marketable e/ 7/	do.	7,500	7,500	10,900	11,000	11,000
Petroleum						
Crude	thousand 42-gallon barrels	234,700	208,400	201,461 r/	234,582 r/	250,000
Refinery products: e/						
Liquefied petroleum gas	do.	20,000	20,000	31,800 r/ 3/	20,000	20,000
Gasoline	do.	23,000	23,000	30,300 r/ 3/	23,000	23,000
Kerosene and jet fuel	do.	53,000	53,000	55,100 r/ 3/	53,000	53,000
Distillate fuel oil	do.	122,000	122,000	136,150 r/ 3/	122,000	122,000
Residual fuel oil	do.	56,000	56,000	74,800 r/ 3/	56,000	56,000
Lubricants	do.	4,000	4,000	4,000 3/	4,000	4,000
Other	do.	67,000	67,000	84,300 r/ 3/	67,000	67,000
Total	do.	345,000	345,000	416,450 r/ 3/	345,000	345,000

e/ Estimated. r/ Revised.

1/ Table includes data available through June 14, 1996.

2/ In addition to commodities listed, other clays (bentonite, common clays, and fuller's earth), other gemstones (aquamarine, emerald, ruby, and spinel), and uranium are produced but output is not reported, and available information is inadequate to make reliable estimates of output levels.

3/ Reported figure.

4/ Excludes production from steel miniplants.

5/ India's marketable production is 10% to 20% of mine production.

6/ The disparity between amounts of mica produced versus amounts exported is based on (a) stockpile, (b) illicit mines, and (c) occasional mining by others seeking additions to income nominally derived from other sources.

7/ Includes reinjected gas.

TABLE 2
INDIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Alumina	Indian Aluminium Co. Ltd. Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%	Belgaum Refinery, Karnataka	220
Do.	National Aluminium Co. Ltd., Indian Government, 100%	Dhamanjodi Refinery, Orissa	800
Do.	Bharat Aluminium Co. Ltd., Indian Government, 100%	Korba Refinery, Madhya Pradesh	200
Do.	Madras Aluminium Co. Ltd. Alumix SpA (Italian Government), 27%; R. Prabhu and Associates, 24%; Tamil Nadu Industrial Investment Corp., 11%, and others, 38%	Mettur Refinery, Tamil Nadu	60
Do.	Indian Aluminium Co. Ltd. Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%	Muri Refinery, Bihar	72
Do.	Hindalco Industries Ltd. Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; and financial institutions, 18%	Renukoot Refinery, Uttar Pradesh	350
Aluminum	Indian Aluminium Co. Ltd. Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%	Alupuram Smelter, Kerala	20
Do.	National Aluminium Co. Ltd., Indian Government, 100%	Angul Smelter, Orissa	218
Do.	Indian Aluminium Co. Ltd. Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%	Belgaum Smelter, Karnataka	70
Do.	do.	Hirakud Smelter, Orissa	30
Do.	Bharat Aluminium Co. Ltd., Indian Government, 100%	Korba Smelter, Madhya Pradesh	100
Do.	Madras Aluminium Co. Ltd. Alumix SpA (Italian Government), 27%; R. Prabhu and Associates, 24%; Tamil Nadu Industrial Investment Corp., 11%; and others, 38%	Mettur Smelter, Tamil Nadu	25
Do.	Hindalco Industries Ltd. Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; and financial institutions, 18%	Renukoot Smelter, Uttar Pradesh	210
Bauxite	Bharat Aluminium Co. Ltd., Indian Government, 100%	Amarkantak Mine, Madhya Pradesh	200
Do.	Indian Aluminium Co. Ltd. Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%	Kolhapur District mines, Maharashtra	600
Do.	Gujarat Mineral Development Corp., Gujarat State Government, 100%	Kutch and Saurashtra Mines, Gujarat	500
Do.	Hindalco Industries Ltd. Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; and financial institutions, 18%	Lohardaga District mines, Bihar	750
Do.	Indian Aluminium Co. Ltd. Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%	do.	200
Do.	National Aluminium Co. Ltd., Indian Government, 100%	Panchpatmali Hills, Koraput District mines, Orissa	2,400
Do.	Minerals & Minerals Ltd., Indian Government, 100%	Richuguta, Palamu District mines, Bihar	200
Barite	Andhra Pradesh Mineral Development Corp. Ltd. Andhra Pradesh State Government, 100%	Cuddapah District mines, Andhra Pradesh	350
Do.	Associated Mineral Corp., 100%	do.	75
Do.	Pragathi Minerals, 100%	do.	50
Do.	Shri C. M. Ram nath Reddy, 100%	do.	75
Do.	Vijaylaxmi Minerals Trading Co., 100%	do.	50
Cement	Larsen and Toubro Ltd., 100%	Awarpur Plant, Maharashtra	2,300
Do.	Century Cement. Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%	Baikunth Plant, Madhya Pradesh	1,120
Do.	Coromandel Fertilizers Ltd. Chevron Chemical Co. (United States), 23.55%; International Minerals and Chemical Co., 20.89%; Parry and Co., 10.64%; E.I.D. Parry (India) Ltd., 6.65%; and others, 38.27%	Chilamkur Plant, Andhra Pradesh	1,000
Do.	The Associated Cement Cos. Ltd. Indian Government, 34.86% and private shareholders, 65.14%	Gagal Plant, Himachal Pradesh	1,830
Do.	Raymond Cement Works, a division of Raymond Woolen Mills Ltd. JK Singhania, principal shareholder	Gopalnagar Plant, Madhya Pradesh	1,250
Do.	Narmada Cement Co. Ltd. Chowgule and Co. Ltd., 34%; Gujarat State Government, 17.33%; and others, 48.67%	Jafrabad Plant, Gujarat	1,000
Do.	Rajashree Cement, a division of Indian Rayon and Industries Ltd., 100%	Khor Plant, Karnataka	1,020
Do.	The Associated Cement Cos. Ltd. Indian Government, 34.86% and private shareholders, 65.14%	Kymore Plant, Madhya Pradesh	1,500
Do.	Mangalam Cement Ltd., 100%	Morak Plant, Rajasthan	1,000

See footnotes at end of table.

TABLE 2--Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Cement--Continued		Mysore Cements Ltd. Government institutions and banks, 41.13%; Corporate Trust holdings, 21.70%; and others, 37.17%	Narasingarh Plant, Madhya Pradesh	1,089
Do.		Cement Corp. of India Ltd., Indian Government, 100%	Nayagaon Plant, Madhya Pradesh	1,330
Do.		J.K. Cement Works, a division of JK Synthetics Ltd., 100%	Nimbahera Plant, Rajasthan	1,462
Do.		The India Cement Co. Ltd. Indian Government, 26%; Life Insurance Corp. of India, 24%; and others, 50%	Sankarnagar Plant, Tamil Nadu	1,000
Do.		Maihar Cement. Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%	Satna Plant, Madhya Pradesh	1,800
Do.		Shree Digvijay Cement Co. Ltd., 100%	Shreeniwas Plant, Maharashtra	1,060
Do.		Lakshmi Cement, a division of Straw Products Ltd. JK Singhania, principal shareholder	Sirohi Plant, Rajasthan	1,400
Do.		Manikgarth Cement. Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%	Tehsil Rajura Plant, Maharashtra	1,000
Do.		Vasavadatta Cement. Kesoram Industries Ltd., 100%	Vasavadatta Plant, Karnataka	1,000
Do.		Vikram Cement. Grasim Industries Ltd., a subsidiary of the Birla Group, 100%	Vikram Plant, Madhya Pradesh	1,000
Do.		Raasi Cement Ltd. Andhra Pradesh Government, 50% and Development Co. Ltd., 50%	Vishnupuram Plant, Andhra Pradesh	1,000
Do.		The Associated Cement Cos. Ltd. Indian Government, 34.86% and private shareholders, 65.14%	Wadi Plant, Karnataka	2,180
Chromite		Ferro Alloys Corp. Ltd., 100%	Cuttack District, Orissa	100
Do.		The Orissa Mining Corp. Ltd., Orissa State Government, 100%	do.	200
Do.		Tata Iron & Steel Co. Ltd., 100%	do.	100
Do.		Ferro Alloys Corp. Ltd., 100%	Dhenkanal District, Orissa	75
Do.		The Orissa Mining Corp. Ltd., Orissa State Government, 100%	do.	200
Do.		Mysore Minerals Ltd., 100%	Hassan District, Karnataka	125
Do.		Ferro Alloys Corp. Ltd., 100%	Kendu'har District, Orissa	75
Do.		The Orissa Mining Corp. Ltd., Orissa State Government, 100%	do.	100
Do.		Ferro Alloys Corp. Ltd., 100%	Khammam District, Andhra Pradesh	100
Coal, bituminous	million tons	Bharat Coking Coal Ltd., a subsidiary of Coal India Ltd., Indian Government, 100%	Bihar and West Bengal	26
Do.	do.	Central Coalfields Ltd., a subsidiary of Coal India Ltd., Indian Government, 100%	Bihar	27
Do.	do.	Eastern Coalfields Ltd., a subsidiary of Coal India Ltd., Indian Government, 100%	Bihar and West Bengal	21
Do.	do.	Mahanadi Coalfields Ltd., a subsidiary of Coal India Ltd., Indian Government, 100%	Orissa	21
Do.		North Eastern Coalfields Ltd., a subsidiary of Coal India Ltd., Indian Government, 100%	Assam	640
Do.	million tons	Northern Coalfields Ltd., a subsidiary of Coal India Ltd., Indian Government, 100%	Madhya Pradesh and Uttar Pradesh	24
Do.	do.	Singareni Collieries Co. Ltd., Andhra Pradesh State Government, 50%, and Indian Government, 50%	Andhra Pradesh	18
Do.	do.	South Eastern Coalfields Ltd., a subsidiary of Coal India Ltd., Indian Government, 100%	Madhya Pradesh	36
Do.	do.	Western Coalfields Ltd., a subsidiary of Coal India Ltd., Indian Government, 100%	Madhya Pradesh and Maharashtra	18
Coal, lignite	do.	Neyveli Lignite Corp. Ltd., Indian Government, 100%	Tamil Nadu	17
Copper		Hindustan Copper Ltd., Indian Government, 100%	Indian Copper Complex mines, Ghatsila District, Bihar	31
Do.		do.	Indian Copper Complex smelter-refinery, Ghatsila District, Bihar	16
Do.		do.	Khetri Copper Complex mines, Khetrinagar Rajasthan	15
Do.		do.	Khetri Copper Complex smelter-refinery, Khetrinagar District, Rajasthan	45
Do.		do.	Malanjkhand Copper Complex mines, Balaghar District, Madhya Pradesh	22
Ilmenite-rutile ore		Kerala Minerals and Metals Ltd., Kerala State Government, 100%	Chavara, Kerala	100
Do.		Indian Rare Earths Ltd., Indian Government, 100%	do.	200
Do.		do.	Ganjam, Orissa	220
Do.		do.	Manavalakurichi, Tamil Nadu	65

See footnotes at end of table.

TABLE 2--Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Iron and steel:			
Crude steel	Steel Authority of India Ltd., Indian Government, 100%	Bhilai steel plant, Madhya Pradesh	4,000
Do.	do.	Bokaro steel plant, Bihar	4,000
Do.	Indian Iron and Steel Co. Ltd., wholly owned subsidiary of Steel Authority of India Ltd., Indian Government, 100%	Burnpur steel plant, West Bengal	1,500
Do.	Steel Authority of India Ltd., Indian Government, 100%	Durgapur steel plant, West Bengal	1,600
Do.	Tata Iron and Steel Co. Ltd., 100%	Jamshedpur steel plant, Bihar	3,200
Do.	Steel Authority of India Ltd., Indian Government, 100%	Rourkela steel plant, Orissa	1,800
Do.	Rashtriya Ispat Nigam Ltd., 100%	Visakhapatnam steel plant, Andhra Pradesh	3,200
Do.	Mini-steel plants, privately owned	Located throughout India, approximately 160	4,700
Iron ore	Steel Authority of India Ltd., Indian Government, 100%	Bastar and Durg District, Madhya Pradesh	7,000
Do.	National Mineral Development Corp. Ltd., Indian Government, 100%	Bellary District, Karnataka	3,000
Do.	Kudremukh Iron Ore Co. Ltd., Indian Government, 100%	Chikmagalur District, Karnataka	7,500
Do.	Chowgule & Co. Pvt. Ltd., 100%	Goa	2,500
Do.	Dempo Mining Corp. Ltd., 100%	Goa	2,500
Do.	V.M. Salgaocar & Bros. Pvt. Ltd., 100%	Goa	2,500
Do.	Steel Authority of India Ltd., Indian Government, 100%	Kendujhar District, Orissa	3,000
Do.	Tata Iron and Steel Co. Ltd., 100%	do.	2,000
Do.	Indian Iron and Steel Co. Ltd., wholly owned subsidiary of Steel Authority of India Ltd., Indian Government, 100%	Singhbhum District, Bihar	2,500
Do.	Steel Authority of India Ltd., Indian Government, 100%	do.	3,500
Do.	Tata Iron and Steel Co. Ltd., 100%	do.	3,500
Kyanite	Associated Mining Co., 100%	Bhandara District, Maharashtra	10
Do.	Maharashtra Mineral Corp. Ltd., 100%	do.	10
Do.	Bihar State Mineral Development Corp. Ltd., Bihar State Government, 100%	Singhbhum District, Bihar	10
Do.	Hindustan Copper Ltd., Indian Government, 100%	do.	22
Lead ore	Hindustan Zinc Ltd., Indian Government, 100%	Agnigundala Mine, Andhra Pradesh	72
Do.	do.	Sargipalli Mine, Orissa	150
Lead, primary	do.	Tundoo Smelter, Bihar	8
Do.	do.	Visakhapatnam (Vizag) Smelter, Andhra Pradesh	22
Lead-zinc ore	do.	Rajpura-Dariba Mine, Rajasthan	900
Do.	do.	Zawar mine group, Rajasthan	1,200
Magnesite	Burn Standard Co. Ltd., Indian Government, 100%	Salem, Tamil Nadu	150
Do.	Dalmia Magnesite Corp., 100%	do.	150
Do.	Tamil Nadu Magnesite Ltd., Tamil Nadu State Government, 100%	do.	150
Manganese ore 1/	Manganese ore (India) Ltd., Indian Government, 100%	Adilabad, Andhra Pradesh	NA
Do.	Falechand Marsingdas, 100%	Andhra Pradesh	NA
Do.	Manganese ore (India) Ltd., Indian Government, 100%	Balaghat, Madhya Pradesh	NA
Do.	J.A. Trivedi Bros., 100%	do.	NA
Do.	Sandur Manganese & Iron Ores Ltd., 100%	Bellary, Karnataka	NA
Do.	Manganese ore (India) Ltd., Indian Government, 100%	Bhandara, Maharashtra	NA
Do.	Eastern Mining Co., 100%	North Kanara, Karnataka	NA
Do.	Mysore Minerals Ltd., 100%	do.	NA
Do.	Manganese ore (India) Ltd., Indian Government, 100%	Keonjhar, Orissa	NA
Do.	Mangilah, Rungta (Pvt.) Ltd., 100%	do.	NA
Do.	Orissa Mining Corp. Ltd., 100%	do.	NA
Do.	Rungta Mines (Pvt.) Ltd., 100%	do.	NA
Do.	Serajuddin & Co., 100%	do.	NA
Do.	S. Lall & Co., 100%	do.	NA
Do.	Tata Iron and Steel Co. Ltd., 100%	do.	NA
Do.	Orissa Mineral Development Co. Ltd., 100%	Koraput, Orissa	NA
Do.	Orissa Mining Corp. Ltd., 100%	do.	NA
Do.	Mysore Minerals Ltd., 100%	Shimoga, Karnataka	NA
Do.	Aryan Mining & Trading Corp., 100%	Sundargarh, Orissa	NA
Do.	Orissa Manganese & Minerals (Pvt.) Ltd., 100%	do.	NA
Do.	Tata Iron and Steel Co. Ltd., 100%	do.	NA
Do.	R.B.S. Shreeram Durga Prasad and Falechand Marsingdas, 100%	Vizianagaram, Andhra Pradesh	NA

See footnotes at end of table.

TABLE 2--Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Petroleum thousand 42-gallon barrels per day	Cochin Refineries Ltd., a subsidiary of Oil and Natural Gas Corp., Indian Government, 55%, and private interests, 45%	Ambalamugal Refinery, Kerala	93,400
do.	Indian Oil Corp., a subsidiary of Oil and Natural Gas Corp., Indian Government, 91%, and private interests, 9%	Barauni Refinery, Bihar	65,800
do.	Bongaigaon Refinery and Petrochemicals Ltd., a subsidiary of Oil and Natural Gas Corp., Indian Government, 100%	Bongaigaon Refinery, Assam	27,110
do.	Indian Oil Corp., a subsidiary of Oil end Natural Gas Corp., Indian Government, 91%, and private interests, 9%	Digboi Refinery, Assam	11,700
do.	Indian Oil Corp., a subsidiary of Oil and Natural Gas Corp., Indian Government, 91%, and private interests, 9%	Guwahati Refinery, Assam	19,920
do.	do.	Haldai Refinery, West Bengal	61,000
do.	do.	Koyali Refinery, Gujarat	185,100
do.	Madras Refineries Ltd., a subsidiary of Oil and Natural Gas Corp., Indian Government, 52%, and private interests, 48%	Madras Refinery, Tamil Nadu	130,660
do.	Bharat Petroleum Corp. Ltd., a subsidiary of Oil and Natural Gas Corp., Indian Government, 67%, and private interests, 33%	Mahul Refinery, Bombay, Maharashtra	134,860
do.	Industan Petroleum Corp. Ltd., a subsidiary of Oil and Natural Gas Corp., Indian Government, 51%, and private interests, 49%	do.	110,452
do.	do.	Vizag Refinery, Andhra Pradesh	90,369
do.	Indian Oil Corp., a subsidiary of Oil and Natural Gas Corp., Indian Government, 91%, and private interests, 9%	Mathura Refinery, Uttar Pradesh	156,000
Phosphate rock 2/	Rajasthan State Mineral Development Corp. Ltd., Rajasthan State Government, 100%	Badgaon, Dakankotra, Kanpur, Kharbaria-ka-Guda, and Sallopat Mines, Rajasthan	NA
Do.	Pyrites Phosphates and Chemicals Ltd., 100%	Durmala and Maldeota underground mines, Uttar Pradesh	NA
Do.	Madhya Pradesh State Mining Corp. Ltd., Pradesh State Government, 100%	Hirapur and Khatamba Mines, Madhya Pradesh	NA
Do.	Rajasthan State Mines and Minerals Ltd., Rajasthan State Government, 100%	Jhamarkotra Mine, Rajasthan	NA
Do.	Hindustan Zinc Ltd., Indian Government, 100%	Maton Mine, Rajasthan	NA
Zinc	Cominco Binani Zinc Ltd., 100%	Binanipuram Smelter, Kerala	20
Do.	Hindustan Zinc Ltd., Indian Government, 100%	Debari Smelter, Rajasthan	49
Do.	do.	Visakhapatnam (Vizag) Smelter, Andhra Pradesh	30

e/ Estimated. NA Not available.

1/ Capacity of clusters of surface mines varies extremely, depending on demand. Estimated total annual capacity is 1.5 million metric tons.

2/ Estimated total annual phosphate rock capacity is 800,000 metric tons.

THE MINERAL INDUSTRY OF

INDONESIA

By Chin S. Kuo

In 1995, Indonesia joined the ranks of the world's top 10 producers of coal, copper, gold, nickel, and tin. The steel industry enjoyed booming demand for steel, and the construction sector was the main user of steel. The oil industry still formed the economic backbone of Indonesia and accounted for 10% of gross domestic product (GDP) and 25% of export earnings. The country was the world's largest exporter of liquefied natural gas (LNG) at around 25 million metric tons per year (Mt/yr). *(See table 1.)*

The country's exports rose 13.5% to $45.4 billion[1] in 1995, and imports surged 25% to $40.7 billion. However, the trade surplus fell to $4.7 billion from $8.1 billion in 1994.

Indonesia was the leading country in attracting foreign investment in the area of mining, particularly for base metals, in Southeast Asia. Illegal mining by Indonesians caused gold loss to the country of about 15 metric tons per year (t/yr).

The Government awarded 40 contracts of work for general mining, of which 10 would involve the exploration for and production of gold. Most of the new contracts, obtained by the foreign mining companies, were to explore and mine in eastern Provinces. In 1995, there were 16 companies operating at the exploration stage in Irian Jaya.

A new Public Mining Law was being prepared by the Government and was expected to be ratified at yearend 1995. It was to take into account new national and international economic and technological developments and conditions unforeseen when the 1967 law came into effect.

Indonesia planned to revise its oil and gas industry regulations to make the sector more competitive. The need for large investments had slowed oil exploration in the past 5 years. The Government proposed to allow for tax consolidation among production-sharing contracts of an oil company to boost exploration. Production-sharing contract terms with Pertamina, the national oil company, were most attractive in the remote eastern region; but the area was considered high risk by foreign oil companies and had little supporting infrastructure.

State-owned general mining company, P.T. Aneka Tambang, prepared to go public on the Jakarta Stock Exchange, while state tin producer, P.T. Tambang Timah, was due to be listed on the London and Jakarta Stock Exchanges in October.

Foreign investment and hence ownership makes a major contribution to the mineral industry through contracts of work or production-sharing contracts. Two major foreign mining companies are engaging in large-scale mining and processing of copper and nickel. The private mining sector still dominates in coal development. *(See table 2.)*

In 1995, RTZ America Inc., a subsidiary of RTZ Corp. Plc. of the United Kingdom, agreed to buy a 10.4% stake in Freeport-McMoRan Copper and Gold Inc. of the United States for $450 million. RTZ America might acquire more than 18% interest for $875 million. Under the terms of the agreement, RTZ America would commit $850 million to joint venture and exploration arrangements and also would spend $100 million for a 40% stake in the Grasberg copper/gold operations and other undeveloped areas. In the block A contract of work area, RTZ America would fund 100% of the defined cost of any expansion projects up to $750 million.

P.T. Freeport Indonesia, 86% owned by Freeport-McMoRan Copper and Gold, was expanding its Grasberg operation to a milling rate of 118,000 metric tons per day (t/d) of ore, yielding 500,000 t/yr of copper and 46,655 kilograms per year (kg/yr) of gold. A feasibility study before yearend was expected to result in further expansion to 175,000 t/d. This proposed expansion would be completed by late 1998.

Freeport Indonesia sold some of its port, marine, logistics, and construction equipment and facilities for $100 million to P.T. Alatief P & O Port Development Co., a foreign investment company. The buyer was to own, operate, and maintain the assets and be responsible for providing the inland marine and land transport.

The first of a three-part transaction was completed for the sale of Freeport Indonesia's existing and to-be-constructed power generation facility to an Indonesian company owned by affiliates of Duke Energy Corp. (30%) and PowerLink Corp. (30%), both of the United States, and Freeport Indonesia (30%) and P.T. Austindo Nusantara Jaya (10%), both of Indonesia.

P.T. Irja Eastern Minerals Corp., which is 80% owned by Freeport McMoRan Copper and Gold and 10% each by P.T. Indocopper Investama and P.T. Setdco Ganesha, had drilled four holes in block 1 of a contract of work area covering 10,000 square kilometers (km^2) for copper. Work on block 1's Kupai area began in May 1994. About 144 holes had been drilled in and around the Wabu area at

Timika composed of some of 26,000 km^2 contract of work area.

Freeport McMoRan Copper and Gold, Mitsubishi Materials Corp. of Japan, and Fluor Daniel Inc. of the United States planned to proceed with the $550 million copper smelter-refinery project at Gresik on East Java. Construction began in October 1995, and production using Mitsubishi's continuous smelting process was expected for the second half of 1998 at a capacity of 200,000 t/yr of copper cathode. A joint venture would be funded by the three companies at 20%, 70%, and 10%, respectively. Fluor Daniel would be the project manager, while Mitsubishi Materials would operate the smelter-refiner and market copper cathode and other products. Freeport Indonesia would supply the smelter's copper concentrate feedstock estimated at 600,000 t/yr. A major fertilizer plant operated by P.T. Petrokimia Gresik would use up to 500,000 t/yr of sulfuric acid generated as a byproduct of the smelting process.

Diamond drillings by P.T. Nabire Bakti Mining indicated significant copper/gold mineralization in its contract of work area on the western neck of Irian Jaya. Trenching also showed the presence of near-surface mineralization. The company is 90% owned by Enaratoli Gold Project Ltd., which is in turn owned by Bureau de Recherches Geologiques et Minieres (34%) of France, Newcrest Ltd. (10%) of Australia, and Felstone Investment Ltd. (56%), controlled by Gencor of South Africa.

Aurora Gold Ltd. of Australia poured the first doré metal in February from its Mount Muro gold and silver mine in Kalimantan. Production capacity was expected to be 3,888 kilograms (kg) of gold and 73,093 kg of silver. Mount Muro is an open pit operation with a mine life of 8 years. Capital expenditure on project development was $64.2 million. Major infrastructure included tailings dam, airstrip, and haulroad development. The company also focused on an advanced prospect at Toka Tindung and three early-stage exploration prospects in gold-bearing regions. Euro-Nevada Mining Corp. of Canada acquired an interest in the Mount Muro project for $18.5 million.

Bre-X Minerals of Canada terminated a joint-venture agreement with Aurora Gold concerning the Sangihe gold project. The company and an Indonesian partner applied for a contract of work covering two blocks on the southern half of Sangihe Island and the northern half of neighboring Karakelong Island. Meanwhile, the company reported progress on its Busang gold project in East Kalimantan. Kilborn Engineering had been engaged to provide an update of resource estimates.

Carrie Pacific Holdings Ltd. of Australia began gold production at its Melawi River alluvial gold project. The company mined 1.68 million cubic meters (m^3) of alluvial ore to produce 467 kg of gold.

Construction of Newmont Gold's $131 million Minahasa gold project on Sulawesi was underway, and production was expected to begin in early 1996 at 4,354 kg/yr. Open pit mining was planned for three deposits with a combined reserve of 9.6 million metric tons (Mt) grading 6.4 grams per metric ton (g/t).[2] Newmont Gold owns 80% of the venture, and the remaining 20% is owned by P.T. Tanjung Serapung. Newmont Gold also has 80% of the Batu Hijau project on Sumbawa Island, from which gold production might begin in late 1997. Capital costs were estimated at $1.5 billion.

Meekatharra Minerals Ltd. of Australia conducted a mine feasibility study of the Way Linggo North Vein gold project in South Sumatra; the study indicated an initial target production of between 1,244 and 1,866 kg/yr of gold and 15,552 kg/yr of silver. Ore treatment would be undertaken in a 120,000-t/yr carbon-in-pulp plant. The deposits had an average grade of 13.3 g/t of gold and 177 g/t of silver.[3] Meekatharra Minerals holds a 40.8% interest in the project, Aurora Gold Ltd. has 44.2%, and an Indonesian business executive has the remaining 15%. In August, Meekatharra Minerals agreed to buy out Aurora Gold's 52% stake in the holding company of P.T. Natarang Mining. The holding company has an 85% equity interest in P.T. Nataranng Mining, which owns the contract of work including Way Linggo North Vein.

P.T. Dwi Tunggal Inti Sakti reported that it discovered gold deposits in the districts of Viqueque and Baucau on East Timor. Laverton Gold of Australia discovered substantial new gold-bearing deposits at its Rawas gold project in southern Sumatra. More than 9,331 kg of gold had been identified in reserves from its three present pits at the project. China National Gold Corp. considered the possibility of cooperating with P.T. Aneka Tambang in the mining of gold in Summatra and Kalimantan. The former would supply equipment and workers, and Aneka Tambang would supply funding.

Aneka Tambang and Pacific Wildcat Resources Corp. (WRC), 26% owned by Gwalia Consolidated of Australia, formed a joint venture to explore a 300-km^2 gold property on Sulawesi. P.T. Bimantara Duta Samudra and another minor equity partner formed an association with WRC to earn an 85% interest in the project. Separately, WRC received approval from the Government to negotiate a contract of work on the Jambi gold project.

South Pacific Resources of Australia began exploration on three previously identified mineral properties on Kalimantan. One of them, the Masuparia project, is adjacent to the Mount Muro Mine and has 14 gold prospects. The other two properties are the Mandor project, a copper/gold porphyry target, and the Sampoit-Sori Hill project, an epithermal gold prospect.

Diadem Resources and Waseco Resources, both of Canada, entered into a letter of intent to earn a 60% interest in the Tewah alluvial gold project in central Kalimantan by either spending $1.5 million on exploration or funding a full feasibility study. The joint venture's other partner was P.T. Mercu Buana Raya Contractors.

P.T. Krakatau Steel was to be privatized in early 1996. The company also discussed possible joint ventures with Pohang Iron and Steel Co. of the Republic of Korea and BHP Steel of Australia. Krakatau Steel operates 2 direct-reduction iron facilities and 10 electric furnaces. Raw steel output was around 2.5 Mt/yr. Steel exports accounted for 20% of sales, of which 10% was flat products to North America.

Kanematsu Corp. of Japan and Alumindo Light Metal Industry of Indonesia formed a joint-venture company, P.T. Maspion Stainless Steel Indonesia, in Manyar-Gresil, East Java, to build a $60 million, 50,000-t/yr stainless steel cold-rolling mill. Startup of production was scheduled for July 1997. The two companies were funding $48 million in equity, and the Export-Import Bank of Japan was to extend $12 million in loans. Sumitomo Metal Industries Ltd. would supply technology to the project and hot-rolled coil from Japan and other sources. Demand for stainless steel was estimated at 40,000 t/yr and was expected to grow to 60,000 t/yr by 1997.

Sanyo Special Steel Co. and Tomen Corp., both of Japan, planned to build a tool steel processing plant in Jakarta to produce and market dies. Construction of the plant was to begin in September 1995. The venture was capitalized at $2.38 million with Sanyo holding 85% and Tomen 15%. Some $8.33 million was to be invested in the projected facility.

P.T. Inco's $500 million expansion project at Soroako, Sulawesi involved construction of a fourth smelting line and increasing hydroelectric generation capacity on the Larona River. The upgraded facility would increase nickel matte production to 68,000 t/yr by late 1998. The project also included the exploration and development of two new deposits in the same general area. In addition, a potential $1 billion plan was to further expand its nickel output to 100,000 t/yr by 2010. However, the plan depended upon future nickel markets and economic conditions. Inco Ltd. of Canada owns 58% of P.T. Inco, which employs 3,000 workers. P.T. Inco was to sign an extension agreement with the Government of its contract of work that would expire in 2025.

P.T. Aneka Tambang produced 2.5 Mt of nickel ore. Part of the nickel ore was exported to Japan and Australia. Completion of a second nickel smelter in 1994 enabled its production and exports of ferronickel to double to around 11,000 metric tons (t) in 1995. The company expanded its ferro-nickel market to the Republic of Korea, Taiwan, and South Africa. It signed a long-term contract with Yieh United Steel Corp. of Taiwan for a total of 25,000 t of ferronickel to be supplied over the next 3 years. Aneka Tambang also made a deal with Pohang Iron and Steel Co. for 12,000 t over 5 years.

P.T. Koba Tin was to construct a tin smelter at its operations on Bangka Island. The new smelter would have an initial capacity of 13,000 t/yr and begin production in mid-1996. The $4 million plant would include two reverberatory furnaces and refining equipment and would treat the concentrate from Koba's mine. The company also planned to expand mining operations at Koba with the addition of a dredge.

P.T. Tambang Timah increased its tin production capacity from 33,500 to 42,400 t/yr with the commissioning of a sixth furnace. A seventh furnace was planned to boost its capacity to 50,000 t/yr. The state-owned tin mining company planned to increase production of nickel ore to 2.75 Mt/yr and ferronickel to 11,000 t/yr in 1996. The company accounted for 80% of the country's total tin output. Indonesia exported 30,500 t of tin in 1995, the same amount as in 1994. Tambang Timah was one of the lowest cost tin producers in the world. The company planned to diversify into coal, gold, and diamond mining in Kalimantan.

Semen Gresik paid $483 million for two Government-owned cement companies, Semen Tonasa and Semen Padang. The acquisition more than doubled the company's capacity to 10.9 Mt/yr. The Government's stake in Semen Gresik fell to 65%. Semen Gresik started construction of its Tuban II project late in 1995; the new cement plant was scheduled for commissioning in mid-1997 and was to include a 7,800-t/d production line.

Ocean Resources signed a $5 million option agreement to purchase two dredges and a fleet of support vessels from Aokkam Thai of Thailand to search for diamonds on the Sunda Shelf offshore of southeast Kalimantan. The search area covered 1,500 km^2 and included the Muluka paleochannel.

Ashton Mining finalized a joint-venture agreement with respect to the Cempaka alluvial diamond project. Parties in the joint venture are Aneka Tambang and Ashton-MMC, which is jointly owned by Ashton Mining and Malaysia Mining Corp. Compilation of drill-hole and bulk-sample results for the Danau Seran paleochannel was underway. Ground geophysical survey had begun at the Cempaka paleochannel. They were to be followed by Bangka drilling.

The country planned to lessen dependence on oil in favor of a mix of other energy sources such as coal, hydroelectric, and nuclear power, since Indonesia soon would become a net oil importer. Coal reserves in Indonesia were estimated at about 36,000 Mt. Coal production was 38.5 Mt in 1995 and would increase to about 80 Mt by the year 2000. Coal exports were expected to be 26.4 Mt, increasing to 35 Mt.

P.T. Adaro Indonesia was to supply a total of 120 Mt of coal over 30 years to the Paiton power generating plant in eastern Java. The company exported 3 Mt/yr of coal in 1995. P.T. Batubara Butik Asam (PTBA) exported about 2.2 Mt/yr of coal to National Power Corp. of the Philippines. Kaltim Prima Coal, a joint venture between

British Petroleum and CRA Ltd. of Australia, planned to float a portion of its shares on the Jakarta Stock Exchange. The company is Indonesia's largest coal producer and has a 30-year contract of work in East Kalimantan. Production for 1995 was expected to be similar to that recorded for 1994.

PTBA was to be restructured with regard to its organization and capital. The restructuring of organization was intended to focus more on the mining and production of coal as its core business, and that of capital would mainly cover the reduction of unproductive assets.

Banpu International Ltd. of Thailand and P.T. Sitrade Nusaglobus agreed to cooperate with P.T. Batubara Bukit Asam in exploring coal over an area of 85,000 hectares (ha) in Sinamar, West Sumatra, and in Mampun, Jambi. Meanwhile, P.T. Esindo Ereshhamas joined Eltin Co. of Australia in a coal mining venture in Padang Sidempuan, South Tapanuli, with an investment of $140 million. Coal deposits were estimated to be between 75 and 100 Mt.[4] The two companies expected to supply 1.5 Mt/yr of coal to a 200-megawatt (MW) powerplant in South Tapanuli to be built by P.T. Ikabina Pabola consortium.

Construction of a coal terminal at Pulau Laut in Kalimantan went ahead after National Australia Bank and Banque Nationale de Paris agreed to provide $75 million to finance the project, which was due to be completed in 1998. Loading capacity was expected to be between 8 and 10 Mt/yr. The terminal would handle vessels up to 100,000 deadweight tons. The facility was to be used predominantly by P.T. Adaro, and, from the terminal, about 4.3 Mt/yr of coal would be supplied to the Paiton Power project.

The country and Exxon Corp. of the United States signed an agreement in January to invest $40 billion in the Natuna natural gas project in the South China Sea. The exploration and exploitation of natural gas would be conducted by Pertamina and an Exxon affiliate, Esso Exploration & Production Natuna Inc. Tests indicated that the natural gas had high carbon-dioxide content at 70%. Gas reserves were estimated to be about 1.27 trillion m^3. Full development of the project would require 18 offshore platforms and 200 production wells. Production at a rate of 56.6 million cubic meters per day (m^3/d) of natural gas could last for 30 years. Japan was given the top priority to buy natural gas from the Natuna Field.

A joint venture by MIM holdings Ltd. of Australia (33.3%) and Apache Oil (38.9%) and Parker & Parsley Petroleum Co. (27.8%), both of the United States, discovered natural gas and condensates in Bentu block, central Sumatra.

Maxus Energy Corp. of the United States discovered natural gas in a well drilled on its 2.06-million-ha Northwest Java concession offshore in the Java Sea. Maxus Energy holds a 24% interest in the concession, and Atlantic Richfield Co., also of the United States, was the project operator with a 46% interest under a production-sharing contract with Pertamina.

Mobil Oil Indonesia planned to develop three new gasfields to supply the Arun LNG plant in Aceh, North Sumatra. Two new fields on South Lhok Sukon were expected to come on-stream in 1997, and the third field, offshore Arun, would be operational by the year 2000.

The Trans-Indonesia Gas Transmission System would connect an existing pipeline on Java with the rest of the country at a cost of $2.7 billion. The Natuna Gasfield in the South China Sea also would be connected to the grid. The first phase included a pipeline between Grisik and Duri on Sumatra. The World Bank was conducting a study on the second phase between Jakarta and Gresik.

A consortium of the Asian Development Bank ($217 million), the European Investment Bank ($58 million), and the Export-Import Bank of Japan ($195 million) agreed to finance Perusahaan Gas Negara's (PGN) first-phase 800-kilometer (km) gas pipeline on Sumatra with a total cost of $588 million. PGN would provide $18 million and plan to issue convertible bonds to raise $100 million. The line would run from Asamera's Corridor Block gasfields to Caltex's Duri oilfields and on to Batam Island as a spur. The main line was scheduled for commissioning in December 1997 and the spur in September 1998. The gas would be used at Duri as fuel for the steamflood system currently in operation.

Six Japanese companies agreed to extend contracts to buy LNG worth $20.1 billion from the Arun plant in Aceh Province and the Bontang plant in East Kalimantan until 2018. They were to import about 11.94 Mt/yr of LNG. Indonesia's annual output of LNG was about 26.27 Mt, or about 30% of the world's total, and was produced from 12 trains. Pertamina also offered 30-year contracts for the LNG from the Natuna Gasfield, which would become its third LNG center, producing 15 Mt/yr. In 1995, Indonesia exported more than 20 Mt/yr of LNG to Japan, the Republic of Korea, and Taiwan. Pertamina would supply 1.8 Mt/yr of LNG to Chinese Petroleum Corp. of Taiwan for 20 years in a deal worth $6 billion.

The Export-Import Bank of Japan led a group of banks to provide 70% of the $970 million towards the cost of constructing a seventh processing train at the Bontang LNG plant. Building of the 2.6-Mt/yr unit was due to start in 1995, with completion set for mid-1997. The refinery was expected to increase Bontang production capacity to 18 Mt/yr, making it the largest LNG plant in the world. Natural gas from Lasmo's Sanga Sanga production sharing contract area would be processed at the plant.

Pertamina planned to drill 128 oil exploration wells in 1995, 11 in the eastern areas and 117 in the west. The total number of production wells was expected to increase to 586. Seismic line operations were expected to rise to 78,800 km. A total of 33 onshore and offshore areas was open for production-sharing contracts. Pertamina signed

18 production-sharing contracts in 1995.

The oil industry produced 1.5 million barrels per day (bbl/d) of crude oil and was dominated by Pertamina. About 70% of the country's output was for domestic consumption, and only 30% was for export. Pertamina launched a cost-cutting program and planned to lay off 13,000 of its 46,000 employees over the next 5 years. The company also considered spinning off its domestic chain of retail gasoline stations.

An export-oriented oil refinery was opened in May 1995. The plant operated at 120,000 bbl/d, near its capacity of 125,000 bbl/d, and its residue catalytic cracker at 80,000 bbl/d, near the 83,000-bbl/d capacity. The refinery produced 54,500 bbl/d of gasoline; 10,400 bbl/d of kerosene; 14,900 bbl/d of industrial diesel; 24,400 bbl/d of automotive diesel fuel; and 7,230 bbl/d of fuel oil. P.T. Hammet Oil Refinery planned to build the eighth new export-oriented refinery in Serang, West Java. The $2 billion refinery would process imported Middle East crude oil.

In another development, a consortium led by P.T. Gigaraya International planned to build a $3.1 billion oil refinery in East Java. Other partners would be Mitsui of Japan and Saudi Arabian Oil Co. Construction was to begin in early 1997, and the refinery would be completed in 3 to 4 years. The refinery was to be supplied with 150,000 bbl/d of crude oil from the Middle East and would produce 2.3 Mt/yr of gasoline, 3 Mt/yr of gas oil, and 2.3 Mt/yr of kerosene and fuel oil.

Marathon Petroleum Indonesia of the United States produced crude oil at 40,000 bbl/d from the KG and KRA fields in the Natuna Sea. The fields would increase output with the existing Kakap facilities to 50,000 bbl/d. Marathon Petroleum Indonesia has a 37.5% interest in the Kakap production-sharing contract, and the other partners are Lasmo (18.75%), Oryx (18.75%), LL&E (15%), and Pertamina (10%). In 1995, Lasmo sold its 18.75% interest to Minora Resources for $29.5 million.

P.T. Caltex Pacific Indonesia, equally owned by Texaco and Chevron of the United States, accounted for nearly one-half of the country's total oil output from four production-sharing contract areas on Sumatra. The Duri steamflood oilfield was the largest such operation in the world.

Unocal Indonesia Ltd., a unit of Unocal Corp. of the United States, discovered a new oil and natural gas field in the Mahakam Delta off eastern Kalimantan. Stirling Resources produced first oil from the offshore Camar oil and gasfield in January. The company has a 16% interest in the Camar Field and associated production facilities. Phillips Petroleum Co. and its partners discovered natural gas and condensate offshore in the Timor Gap.

Total (30%) of France signed an exploration contract with Asamera (45%), a subsidiary of Gulf Canada Resources, for drilling in the Jambi B production-sharing contract area in South Sumatra. Pertamina owns the remaining 25% of the project.

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[1] Where necessary, values have been converted from Indonesian rupiahs (Rp) to U.S. dollars at the rate of Rp2,204=US$1.00 for 1995.

[2] Northern Miner, Jan. 16, 1995, p. 1.

[3] Mining Magazine, Jan. 1995, p. 57.

[4] Southeast Asia Mining Letter, Mar. 17, 1995, p. 8.

Major Sources of Information

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Jakarta 12790, Indonesia
Directorate of Mineral Resources and Geological
Research and Development Center
Jl. Diponegoro 57
Bandung 40122, Indonesia
Directorate General of Oil and Gas
Jl. M.H. Thamrin No. 1
Jakarta Pusat, Indonesia

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Monthly Statistical Bulletin—Economic Indicator.
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Petroleum and Natural Gas Industry of Indonesia, monthly.

TABLE 1
INDONESIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
METALS						
Aluminum:						
Bauxite, gross weight	thousand tons	1,406	804	1,320	1,342	899 2/
Metal, primary		187,000	173,000	205,526	221,900	220,000
Chromite sand, dry basis e/		1,950 2/	2,000	2,500	2,500	2,500
Copper, mine output, Cu content		211,692	280,819	298,648	322,190	443,618 2/
Gold, mine output, Au content 3/	kilograms	16,879	37,983	42,097	42,600	62,800 2/
Iron and steel:						
Iron sand, dry basis		173,242	287,821	341,335	334,895	340,000
Metal:						
Ferroalloys: Ferronickel e/		25,000	26,000	27,000	27,000	27,000
Steel, crude		3,250,000	3,171,072	1,947,511	2,000,000 e/	2,050,000
Manganese: e/						
Ore		13,253 2/	13,000	14,000	14,000	14,000
Ferromanganese		--	--	10,000	10,000	10,000
Nickel:						
Mine output, Ni content 4/		71,681	77,600	65,800	81,100	88,183 2/
Metallurgical products:						
Matte: Ni content		27,433	39,307	36,987	45,300	46,129 2/
Ferronickel: Ni content		5,318	5,506	5,266	5,745	10,735 2/
Silver, mine output, Ag content	kilograms	80,294	99,941	90,301	107,000	182,982 2/
Tin:						
Mine output, Sn content		30,061	29,400	29,000 e/	30,610	38,378 2/
Metal		30,415	31,915	30,415	31,100	38,628 2/
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand tons	16,153	17,280	18,934	19,000 e/	19,500
Clays:						
Bentonite		21,512	17,960	13,707	14,409	26,057 2/
Fireclay e/		1,850,000	1,900,000	1,950,000	1,950,000	2,000,000
Kaolin powder		139,915	230,550	42,365	53,236	14,000
Diamond: e/						
Industrial stones	thousand carats	24	21	20	22	22
Gem	do.	8	6	7	6	7
Total	do.	32	27	27	28	29
Feldspar		13,674	16,719	27,835	40,483	49,415 2/
Gypsum		404,310	400,000 e/	1,646	1,286	1,327 2/
Iodine	kilograms	36,353	35,000 e/	14,180	89,098	76,821 2/
Nitrogen: N content of ammonia		2,706,268	2,687,818	2,888,000	2,800,000 e/	2,850,000
Phosphate rock e/		6,384 2/	8,000	7,000	7,000	7,500
Salt, all types e/	thousand tons	610	630	650	650	670
Stone:						
Dolomite		10,000 e/	11,414	4,534	4,386	4,056 2/
Granite	thousand tons	1,200 e/	2,907	2,767	5,129	3,066 2/
Limestone	do.	2,573	3,796	4,000 e/	20,814	13,143 2/
Marble	square meters	378	1,989	3,000	15,286	10,446 2/
Quartz sand and silica stone		429,251	400,000 e/	239,769	588,429	278,925 2/
Sulfur, elemental e/		3,600	3,600	3,500	3,500	3,500
Zeolite		600 e/	70	60	70	70
MINERAL FUELS AND RELATED MATERIALS						
Coal	thousand tons	13,688	22,357	27,583	30,934	41,080 2/
Gas, natural:						
Gross	million cubic feet	2,035,058	2,582,641	2,661,878	2,940,000	2,900,000
Marketed e/	do.	1,400,000	1,600,000	1,600,000	1,700,000	1,700,000
Petroleum:						
Crude including condensate	thousand 42-gallon barrels	581,232	550,668	557,661	588,000	580,000

See footnotes at end of table.

TABLE 1--Continued
INDONESIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum--Continued:						
Refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	3,453	4,224	3,600 e/	3,800 e/	3,900
Gasoline	do.	42,137	43,814	45,000 e/	45,000 e/	46,000
Jet fuel	do.	6,580	6,341	6,000 e/	6,200 e/	6,200
Naphtha	do.	14,078	12,435	20,000 e/	18,000 e/	19,000
Paraffin wax	do.	183	140	190 e/	200 e/	200
Kerosene	do.	47,326	48,996	50,000 e/	50,000 e/	51,000
Distillate fuel oil	do.	76,592	82,046	77,000 e/	80,000 e/	79,000
Lubricants	do.	1,462	1,724	1,600 e/	1,800 e/	1,700
Residual fuel oil	do.	26,975	28,992	30,000 e/	30,000 e/	30,000
Unfinished oil for processing	do.	44,251	50,820	43,000 e/	45,000 e/	46,000
Refinery fuel and losses	do.	12,490	12,569	14,000 e/	15,000 e/	15,000
Unspecified	do.	2,936	842	2,500 e/	2,000 e/	2,200
Total	do.	278,463	292,943	292,890 e/	297,000 e/	300,200

e/ Estimated.

1/ Table includes data available through May 21, 1996.

2/ Reported figure.

3/ Includes Au content of copper ore and output by Government-controlled foreign contractors' operations. Gold output by operators of so-called people's mines and illegal small-scale mines is not available but may be as much as 15 metric tons per year.

4/ Includes a small amount of cobalt that is not recovered separately.

TABLE 2
INDONESIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Locations of main facilities	Annual capacity
Aluminum:			
Bauxite	P.T. Aneka Tambang (Government, 100%)	Kijang, Bintan Island	1,300
Metal	P.T. Indonesia Asahan Aluminum (Nippon Asahan Aluminum Co. of Japan, 59%; and Government, 41%)	Kual Tanjun, north Sumatra	225
Cement	P.T. Indocement	Citeureup, west Java	8,000
Do.	P.T. Semen Cibinong	Narogong, east Java	1,400
Do.	P.T. Semen Gresik	Gresik, east Java	1,500
Do.	P.T. Semen Padang	Indarung, west Java	2,200
Coal	P.T. Allied Indo Coal (Allied Indonesia Coalfields Pty. Ltd. of Australia, 60%; and P.T. Mitra Abadi Sakti of Indonesia, 20%)	Parambahan, west Sumatra	500
Do.	P.T. Tambang Batubara Bukit Asam (Government, 100%)	Bukit Asam, south Sumtra	4,000
Do.	Perum Tambang Batubara (Government, 100%)	Ombilin, west Sumtra	1,000
Copper, in concentrate	P.T. Freeport Indonesia Co. (Freeport McMoRan Copper and Gold Inc. of the United States, 80%; Government, 10%; and others, 10%)	Ertsberg and Grasberg, Irian Jaya	350
Granite	P.T. Karium Granite (subsidiary of P.T. Pandawa Sempurna of Indonesia)	Karium Island	2,000
Petroluem, crude thousand barrels per day	Atlantic Richfield Indonesia, Inc. (subsidiary of ARCO of the United States)	Arjuna and Arimbi, offshore, west Java	170
Do.	Maxus Southeast Asia Ltd. (subsidiary of Maxus Energy of the United States)	Cinta and Rama, offshore, southeast Sumatra	95
Do.	PERTAMINA (Government, 100%)	Jatibarang, west Java, and Bunyu, offshore east Kalimantan	80
Do.	P.T. Caltex Pacific Indonesia (Texaco Inc., 50%; and Chevron 50%, both of the United States)	Minas, Duri, and Bangko, central Sumatra	700
Do.	Total Indonesia (subsidiary of Compagnie Francaise des Petroles of France)	Handi and Bakapai onshore and offshore east Kalimantan	180
Gas:			
Natural million cubic feet per day	Mobil Oil Indonesia, Inc. (subsidiary of Mobil Corp. of the United States)	Arun, Aceh in north Sumatra	1,700
Do.	Roy M. Huffington (subsidiary of HUFFCO of the United States)	Badak, east Kalimantan	1,000
Liquefied	P.T. Arun LNG Co. Ltd. (Government, 55%; Mobil Oil, 30%; and the Japan Indonesia LNG Co., 15%)	Balang Lancang, Aceh in north Sumatra	10,000
Do.	P.T. Badak LNG Co. Ltd. (Government, 55%; HUFFCO Group, 30%; and the Japan Indonesia LNG Co., 15%)	Bontang, east Kalimantan	7,900
Nickel:			
In ore	P.T. Aneka Tambang (Government, 100%)	Pomalaa, south Sulawesi and on Gebe Island, Moluccas	34
In matte	P.T. International Nickel Indonesia (Inco Ltd. of Canada, 78%; Sumitomo Metal Mining Co. Ltd. of Japan, 20%; other, 2%)	Soroako, south Sulawesi	45
Nitrogen	P.T. Aseah-Aech Fertilizer (Government, 60%; other members of Asean 40%)	Lhokseumawe, north Sumatra	506
Do.	P.T. Pupuk Iskandar Muda (Government, 100%)	do.	506
Do.	P.T. Pupuk Kalimantan Timur (Government, 100%)	Bontang, east Kalimantan	1,012
Do.	P.T. Pupuk Sriwijawa (Government, 100%)	Palembang, south Sumatra	1,438
Steel, crude	P.T. Krakatau Steel (Government, 100%)	Cilegon, west Java	2,000
Tin:			
In ore	P.T. Koba Tin (Government, 25%; Renison Goldfields Consolidated Ltd. of Australia, 75%)	Koba, Bangka Island	6
Do.	P.T. Tambang Timah (Government, 100%)	Onshore and offshore islands of Bangka, Belitung, and Singkep	32
Metal, refined	Peleburan Timah Indonesia (Government, 100%)	Mentok, Bangka Island	32

THE MINERAL INDUSTRY OF

JAPAN

By John C. Wu

Japan is a mineral-poor country. Its reserves of crude petroleum, natural gas, and most nonfuel minerals are very small. However, its reserves of iodine, limestone, silica stone and sand, and pyrophyllite are quite large and of world significance. Japan relied on imports to meet most of its raw material requirements for energy and most nonfuel minerals for its world-class mineral processing and manufacturing sectors. Japan also relied on imports to meet some of its requirements for base and rare metals, industrial mineral products, and refined petroleum products.

On January 17, 1995, a powerful earthquake (7.2 on the Richter scale) struck Kobe and the surrounding cities in the Kinki Region of western Japan. The devastating quake, with a horizontal swing of 18 centimeters, took 4,319 lives and caused extensive damages to the buildings, schools and medical facilities, houses, railroads, highways, bridges, port facilities, power lines, supply net works of gas and water, industrial materials production facilities, including several major mineral-processing and metal-fabricating facilities in the Amagasaki, Ashiya, Kobe, Nishinomiya, and Osaka areas.

After the earthquake, several major metal-production facilities in those areas were shut down or were temporarily put out of commission. Severely damaged ferrous and nonferrous metals- production facilities were the wharf, blast furnace, converter, rolling mill, and utilities system of the Kobe Steel Works of Kobe Steel Ltd. in Kobe; east and south wharfs, power supply and control cable system, and power station of the Kakogawa Steel Works of Kobe Steel in Kakogawa, Hyogo Prefecture; and the lead and zinc smelter and refinery of Sumitomo Metal Mining Co. Ltd. in Harima, Hyogo Prefecture. Other minor damaged metal-production facilities were Nishinomiya Steel Mill of Kawasaki Steel Corp., Sakai Steel Works of Nippon Steel Corp., Amagasaki Steel Works of Sumitomo Metal Industries Ltd., and the titanium sponge metal and high-purity silicon plants of Sumitomo Sitix Corp. However, according to the officials of MITI's Kinki Bureau and Kobe Steel, all ferrous and nonferrous metals production plants and facilities had returned to their normal operations by the end of August 1995.

Despite the devastating effects of the Hanshin (Osaka-Kobe) earthquake in 1995, Japan remained the world's largest producer of cadmium metal, indium metal, iodine, electrolytic manganese dioxide, pyrophyllite, selenium metal, steel, and tellurium metal. It was the world's second largest producer of cement, high-purity gallium metal, pig iron, nickel metal, and titanium sponge. Japan was the world's third largest producer of copper metal, limestone, and zinc metal.

In 1995, Japan was one of the world's top consumers and importers of primary aluminum, cadmium metal, chromite, coal, cobalt metal, copper ore and metal, diamond, ferrochromium, fluorspar, gallium metal, iron ore, ilmenite and rutile, industrial salt, lead ore and metal, liquefied natural gas (LNG), manganese ore, nickel ore and metal, crude petroleum, potash, phosphate rock, precious metals, rare earths, silicon, steel, zinc ore and metal, and zircon. On the other hand, Japan was one of the world's major exporters of cement, fertilizer materials, iodine, electrolytic manganese dioxide, high-purity rare metal products, steel products, and titanium sponge metal and mill products.

In 1995, the value of output by the mining sector was about \$10 billion[1] at current prices, accounting for about 0.21% of Japan's gross domestic product in 1995. However, the mineral processing sector, which contributed about 5% to Japan's GDP, played a very important role in providing the primary materials for the world-class manufacturing sector of the Japanese economy and played a significant role in providing ferrous and nonferrous metals, and industrial mineral products to the growing economies of China, the Republic of Korea, Malaysia, Singapore, Taiwan, and Thailand.

Japan was an important market for U.S. exports of primary aluminum, beryllium metal, boron oxide and acid, chromium oxide and hydroxide, coal, copper (concentrate and refined metal), ferrous and nonferrous scrap metals, lead ore and concentrate, lithium oxide and hydroxide, dust and powder of precious stones (abrasive), primary magnesium, molybdenum (concentrate and metal), phosphate rock, high-purity silicon, soda ash, tantalum metal and powder products, refined petroleum products (especially petroleum coke), uranium oxide and other compounds, and zinc ore and concentrate. On the other hand, Japan was an important supplier of fabricated aluminum mill and copper mill products, cement, iodine, iron oxide, high-purity rare metals, high-quality steel products, titanium sponge, titanium scrap, and titanium powder to the United States.

Government Policies and Programs

The underlying mineral policy of Japan was to secure a stable supply of raw material requirements for its national security and growing economy. However, to achieve that overall policy objective for the next 10 years, the Ministry of International Trade and Industry (MITI) had set three additional objectives for the non-ferrous minerals sector. These objectives were (1) to improve competitiveness of domestic nonferrous metal smelters in the world market, (2) to encourage and support Japanese trading and mining companies to participate in overseas nonferrous minerals exploration and development projects, and (3) to encourage and support Japanese trading and mining companies to establish and invest in nonferrous metal smelting business overseas.

To achieve these policy objectives, the Government had designated the nonferrous metal-smelting industry as one of the depressed industries and provided financial assistance for restructuring of the industry and for development of a more competitive technology for nonferrous metal smelting and recycling. The Government also had provided technical and financial assistance with low-interest loans to support Japanese companies to develop overseas nonferrous metal mines.[2]

In 1995, the Government, through MITI's affiliated Metal Mining Agency of Japan (MMAJ),signed several cooperation agreements with mineral-rich countries to transfer mineral processing and pollution prevention technologies, as well as to participate in joint exploration for nonferrous minerals. In March 1995, MMAJ acted as a subcontractor to Japan's New EnergyIndustrial Technology Development Organization and signed a research cooperation agreement with Kazakstan's Eastern Research Mining and Metallurgical Institute for Nonferrous Metals for transferring leaching technology. The 7-year project involved construction and management of a pilot plant by MMAJ. The pilot plant will use the solvent extraction-electrowinning (SX-EW) technology to recover copper, gold, lead, silver, and zinc from residue (polymetallic slag) in eastern Kazakstan.[3]

In July 1995, MMAJ and the Japan International Cooperation Agency (JICA) agreed to provide development assistance to Albania at the request of Albanian Government in February 1995. The development aid involved a 3-year full-scale survey of chromium resources in central Albania. In September 1995, a group of geologists and mining specialist from MMAJ and JICA arrived in the Shebenik area, about 80 kilometers (km) southeast of Tirana (the national capital of Albania), to investigate chromium reserves in a 600-square-kilometer (km^2) area. According to MMAJ, the Shebenik area is known for having large-scale ultra-basic rock formations and about 300 sites show the existence of chromium reserves. Japan planned to invest about $1 million in the next 3 years for boring, sampling, and other activities.[4]

In August 1995, MMAJ and JICA agreed to provide assistance to Zimbabwe for exploring platinum resources in a 150-km^2 area of the Snake-Head region, about 150 km north of Harare (the national capital of Zimbabwe) at the northern tip of Great Dyke. The Great Dyke has composite layers of basic to ultra-basic rock with chromiun and platinum group metals. The 3-year joint exploration with Zimbabwe's Ministry of Mines began in late 1995.[5]

In October 1995, a team of technical experts from MMAJ and JICA arrived in Oman to carry out exploration for copper, chromium, gold, silver, and other metals in a 3,300-km^2 area located in the Batinah region between the Gulf of Oman and the Hajar Mountains. The $2-million joint exploration project, which involved minerals exploration and training of Omanis in the evaluation of mineral deposits, was undertaken under an agreement signed between MMAJ, JICA, and Oman's Ministry of Petroleum and Minerals in February 1995.

In October 1995, MMAJ and JICA also signed an agreement with Tanzania's Ministry of Water, Energy and Minerals to jointly explore for gold in the Igengi area (60 km^2), the Mhunze area (150 km^2), and the Ibologero area (270 km^2), south of Lake Victoria, about 400 km northwest of Dodoma (the national capital of Tanzania). The 3-year exploration project began in December 1995.[6]

Environmental Issues

For the implementation of mining-related pollution prevention program in fiscal year 1994 ending March 31, 1995, MMAJ spent about 17% of its annual budget, or $62.7 million. According to the MMAJ annual report, by the end of the fiscal year, MMAJ had investigated 167 abandoned mines and had reported to the regional government the results of its investigation. MMAJ planned to carry out 43 pollution prevention construction projects out of 167 abandoned mines and planned to manage 41 sites out of the 43 projects. In fiscal year 1995, about $64 million was appropriated through MITI's annual budget for mining-related pollution prevention program. This fund was again implemented through MMAJ.

Production

Mine production of all nonferrous minerals continued the 1994 downward trend resulting from the fast depleting domestic ore reserves and further appreciation of the Japanese yen. Mine production of almost all industrial minerals and construction-related materials was at a lower level than that of 1994 owing to the continued weakness in the general economic condition in 1995.

In the mineral fuels sector, with only three major coal mines operating, coal output dropped to a record low in 1995. The Sorachi coal mine in Utashinai, Hokkaido Prefecture, was closed on March 3, 1995. Output of both natural gas and crude petroleum was also at a lower level than that of 1994.

In the mineral-processing sector, metal production of bismuth, cadmium, copper, cobalt, ferroalloys, gold, indium, manganese dioxide, molybdenum, nickel, rare-earth oxide, steel, titanium sponge, and zinc increased from that of 1994 because of the short supply and higher prices. Production of most industrial mineral products decreased in 1995. Cement production declined slightly in 1995 resulting from general market contraction and restructuring of the industry. Production of most refined petroleum products rose slightly in 1995 owing to a higher demand for gasoline, naphtha, and distillate fuel oil. *(See table 1.)*

Trade

Japan was a major world importer of mineral fuels, nonfuel minerals, and nonferrous metals. It was also a major world exporter of processed minerals in 1995. According to the Ministry of Finance, import bills of coal, crude and partially refined petroleum, LNG, and refined petroleum products, rose from $47.8 billion in 1994 to 53.4 billion in 1995 owing to increased imports of coal and refined petroleum products. Import bills for nonfuel minerals and metals also rose from $18.3 billion in 1994 to $24.7 billion owing to increased quantity of imports and higher prices of ferrous and nonferrous minerals and metals. Imports of mineral fuels and nonfuel minerals and metals accounted for 15.9% and 7.3%, respectively, of Japan's total import bills in 1995.

Total exports of minerals commodities, including iron and steel, nonferrous metals, and industrial minerals, rose sharply from $28.9 billion in 1994 to 34.3 billion, accounting for 7.7% of Japan's total exports in 1995. Exports of iron and steel increased to $17.5 billion in 1995 from $14.8 billion in 1994. Exports of nonferrous metals and fabricated metal products rose to $11.3 billion in 1995 from $9.4 billion in 1994. Exports of industrial minerals also increased to $5.5 billion in 1995 from $4.7 billion in 1994. The increased export earnings from mineral commodities in 1995 was attributed mainly to higher export prices.

The United States remained Japan's most important trade partner because of its significant role in supplying Japan with a wide variety of raw materials, foodstuffs, and manufactured products. In overall merchandise trade, Japan's exports to the United State rose to $120.9 billion in 1995 from $117.6 billion in 1994, accounting for 27.3% of Japan's total exports in 1995. Imports from the United States also rose to $75.4 billion in 1995 from $62.7 billion in 1994, accounting for 22.4% of Japan's total imports in 1995. However, Japan's overall merchandise trade surplus with the United States shrank from $54.9 billion in 1994 to $45.4 billion in 1995 as a result of a substantial increase in imports from the United States.

Structure of the Mineral Industry

In terms of the number of establishments, employment, and gross value of production, Japan's mineral industry consisted of a small nonferrous-metal-mining sector, a small coal-mining sector, a large industrial-minerals mining sector, and a large world-class ferrous and nonferrous-minerals processing sector. Mining- and mineral- processing businesses were owned and operated by private companies incorporated in Japan.

Because of the high value of the Japanese yen and economic recession during the first one-half of the 1990's, the minerals industry continued to cut its work force and output capacity in 1995. Contraction in the coal- and nonferrous-metal-mining sectors in the first one half of 1990's had extended to the nonferrous metals processing sector mainly because of higher value of the Japanese yen and high power cost. In 1995, two lead smelters closed down, and two lead smelters converted to a secondary lead smelter by recycling batteries. One major magnesium refinery, one major chromium metal refinery, one electrolytic manganese dioxide refinery, and one zinc refinery were permanently closed. One major zinc refinery was expected to be closed in June 1996.

According to MITI, coal was produced from three major mines and several small-scale mines in the Hokkaido and Kyushu areas with a total capacity of about 6.7 million metric tons per year (Mt/yr) and a work force of 2,700 in 1995. The number of operating nonferrous metal mines was reduced from 20 in 1994 to 19 in 1995, and employment declined from 1,427 in 1994 to 1,279 in 1995. The number of operating industrial minerals mines declined from 565 in 1994 to 557 in 1995, and employment declined from 12,810 in 1994 to 12,515 in 1995.

In line with the overall mineral industry's restructuring program, the steel industry, with an excess of workers, cut its employment from 271,905 in 1994 to 255,875 in 1995. However, the iron and steel industry increased its pig iron production capacity from 95.2 Mt/yr in 1994 to 95.5 Mt/yr in 1995 and raised its steelmaking capacity from 147.5 Mt/yr in 1994 to 149.8 Mt/yr in 1995. Despite a higher value of the Japanese yen and lower tariff on imports of nonferrous metals, Japan's refining capacity of copper remained unchanged at 1.3 Mt/yr because of strong domestic demand. However, the zinc-refining capacity was reduced to 754,800 metric tons per year (t/yr). Lead refining capacity was also reduced to 249,000 t/yr in 1995, but the two primary lead smelters had converted to a secondary smelter to recycle batteries in 1995. *(See table 2.)*

According to the Statistics Bureau of Japan's Management and Coordination Agency, the number of persons employed by the mining industry in 1995 declined to 50,000, accounting for 0.075% of the Japanese labor force of 66.7 million, compared with 60,000 persons, accounting for 0.094% of 63.8 million in 1990.

Commodity Review

Metals

Aluminum.—Production of primary aluminum by Nippon Light Metal Co. Ltd. at its Kanbara plant in Shizuoka Prefecture increased slightly, but remained insignificant in 1995. Since the mid-1980's, Japan had been dependent on primary aluminum imports to meet virtually all of its annual primary aluminum requirements. Japan was the world's largest importer of primary aluminum, accounting for 25% of the primary aluminum traded in the world market, and was the world's second largest consumer of primary aluminum in 1995.

According to MITI, imports of primary aluminum increased from 2.33 million metric tons (Mt) in 1994 to 2.43 Mt (in metal content of primary aluminum and alloy ingots) in 1995. The yearend overall stocks of primary aluminum by producer, dealer, and consumer increased from 385,940 metric tons (t) in 1994 to 405,216 t in 1995.

According to the Ministry of Finance, imports of primary aluminum totaled 2,802,781 t in 1995, of which 145,316 t was high-grade ingot, 1,901,106 t was regular-grade ingots, and 756,359 t was alloy ingot. Because of its heavy reliance on imports, Japan widely diversified its overseas sources of primary aluminum into more than 50 countries. However, about 66% of Japan's primary aluminum imports in 1995 was from seven major primary aluminum-producing countries, including Australia, Brazil, Canada, Indonesia, New Zealand, the United States, and Venezuela, where Japan's overseas aluminum smelting operations are located. Russia had moved up to the second largest suppliers of primary aluminum to Japan providing 443,439 t in 1995. The other major suppliers of primary aluminum in 1995 were Brazil, providing 500,548 t; Australia, 383,852 t; the United States, 226,002 t; Canada, 224,574 t; Venezuela, 194,287 t; and New Zealand, 176,464 t.

Domestic demand for primary aluminum totaled 2,259,541 t in 1995. According to MITI, consumption of primary aluminum by the aluminum rolling and aluminum casting sectors increased in 1995 owing to the continued improvement in the manufacture of automobiles, aluminum cans, building materials, and home electric appliances. In 1995, consumption of primary aluminum by sector was as follows: 1,874,789 t by aluminum rolling; 106,596 t by aluminum casting; 93,250 t by secondary smelting; 89,220 t by wire and cable; and 95,686 t by aluminum diecasting, steel deoxidization, and other.

Chromium.—Domestic mine production of chromium ore concentrate was by Nippon Chrome Industries Ltd. from the Wakamatsu Mine in Tottori Prefecture. The mines was operating with only 38 workers in 1995. Japan relied on imports to meet almost all of its chromium requirements in 1995.

Imports of metallurgical- and refractory-grade chromite totaled 607,268 t in 1995. South Africa and Iran were two dominant suppliers of chromite, providing 342,599 t and 100,100 t, respectively, in 1995. Other important suppliers of chromite were India, 70,375 t; Madagascar, 42,255 t; and Kazakstan, 29,636 t.

According to MITI, consumption of chromite by the ferroalloy industry increased to 437,343 t in 1995 from 394,742 t in 1994. Ferrochromium was produced by four companies in 1995. Japan Metal and Chemical Co. Ltd. operated a 62,800-t/yr plant at Kita Kyushu in Fukuoka Prefecture and a 21,000-t/yr plant at Oguni in Yamagata Prefecture. NKK Corp. operated two plants with combined capacity of 62,100-t/yr at Toyama in Toyama Prefecture. Nippon Denko K.K. operated a 18,600-t/yr plant at Hokuriku in Toyama Prefecture. Showa Denko K.K. operated a 20,700-t/yr plant at Chichibu in Saitama Prefecture and a 70,000-t/yr plant at Shunan in Yamaguchi Prefecture.

Imports of ferrochromium increased to 825,718 t in 1995 from 610,163 t in 1994 because of an increase in domestic demand for ferrochromium by the producers of chromium-base stainless steel. In 1995, South Africa remained the dominant supplier of ferrochromium, providing 393,774 t, or 48% of the 1995 ferrochromium imports. Other major suppliers in 1995 were China, 164,100 t; India, 80,798 t; Zimbabwe, 73,680 t; Russia, 38,015 t; and the Philippines, 22,807 t.

Following the joint-venture project of Nippon Denko with Samancor Ltd. of South Africa in 1993, Showa Denko K.K. and Marubeni Corp., a major trading company, signed an agreement with Samancor Ltd. of South Africa in June 1995 for the establishment of a joint-venture firm in Johannesburg, South Africa, in July 1995 to produce and market the low-carbon ferrochromium and silicochromium in Middelburg, South Africa. According to the agreement, the joint-venture firm, called Middelburg Technochrome Pty. Ltd., was 65.5% owned by Samancor, 20.7% by Showa Denko, and 13.8% by Marubeni. The plant's capacity in Middelburg was 36,000 t/yr of low-carbon ferrochromium and 24,000 t/yr of ferro silicochromium. Production had started in July 1995 using Showa Denko technology. Marubeni Corp. was to market the products in Japan.[7]

According to a Japanese industry source, in late 1995, the Japan Metal and Chemicals Co., Japan's second largest ferrochromium producer, and Mitsui & Co., a major Japanese trading company, established a joint-venture firm with Zimbabwe Alloys Ltd. of Zimbabwe to produce low-carbon ferrochromium beginning in April 1996. The joint-venture firm was 50% owned by Zimbabwe Alloys and 25% owned each by the Japan Metal and Chemicals and Mitsui & Co. The two Japanese companies will have the rights to take delivery of 14,000 t/yr of ferrochromium from Zimbabwe Alloys.

In 1995, Japan remained the world's leading producer of chromium metal. Production of chromium metal with 99.95% purity declined to about 900 t in 1995 from 3,300 t in 1993. Nippon Denko K.K. operated a 700-t/yr plant using an aluminothermic process at Tokushima in Tokushima Prefecture. Tosoh Corp. operated a 3,600-t/yr plant using the electrolytic process at Yamagata in Yamagata Prefecture. However, Tosho closed down its plant and ceased production in March 1995 because of the high value of the Japanese yen and a redevelopment program around Japan Rail Yamagata station, where the Tosoh chromium metal plant is located. In 1992, Tosoh conducted a joint feasibility study with Samancor for construction of a 3,600-t/yr chromium metal plant in South Africa using Tosoh's technology. However, because of the market conditions, it was decided in 1995 not to construct the metal plant in South Africa.[8]

Copper, Lead, and Zinc.—In 1995, domestic mine production of copper, lead, and zinc decreased to a record low. The amount of domestic mine production of copper, lead, and zinc was equivalent to about 0.17%, 3.22%, and 12.66%, respectively, of Japan's apparent consumption of copper, lead, and zinc metals in 1995.

According to MITI's Mining Division, Kamioka Mining and Smelting Co. Ltd. and Toyoha Mining Co. Ltd. were the two major nonferrous metal mining companies operating in 1995. Kamioka Mining and Smelting mined lead and zinc at its Tochibora deposit of the Kamioka Mine in Gifu Prefecture; while Toyoha Mining mined lead and zinc at its Soya, Izumo, and Shinano deposits of the Toyoha Mine in Hokkaido in 1995.

In 1995, crude ore production at the Kamioka Mine was about 897,000 t, averaging 0.3% lead and 4.1% zinc plus 18 grams per metric ton (g/t) of silver. The Kamioka's Shikama concentrator produced about 3,000 t of lead concentrate, averaging 65.5% lead and 8.0% zinc plus 3,600 g/t of silver; and 58,500 t of zinc concentrate, averaging 59.7% zinc and 0.4% lead plus 58 g/t of silver.

Crude ore production at the Toyoha Mine was about 480,000 t, averaging 0.3% copper, 2.1% lead, and 13.0% zinc plus 210 g/t of silver in 1995. The Toyoha concentrator produced about 7,200 t of copper concentrate, averaging 20.6% copper and 2,300 g/t of silver; 12,500 t of lead concentrate, averaging 57.4% lead and 1,700 g/t of silver; 104,000 t of zinc concentrate, averaging 55.0% of zinc and 420 g/t of silver; and 36,300 t of pyrite concentrate, averaging 43.0% sulfur and 100 g/t of silver.

To extend the mining life of the Kamioka Mine and Toyoha Mine, MMAJ and the two companies were jointly conducting a 4-year (fiscal year 1994-98) detailed geological survey involving underground drilling and exploratory tunneling programs in the Sakonishi district of the Hida area near the Kamioka-Mozumi deposit in Gifu Prefecture and in the southern district of the Jozankei-Toyoha area near the Toyoha Mine in Hokkaido. MMAJ discovered mineralization of zinc in the Hida area and copper, gold, indium, lead, silver, and zinc in the Jozankei area in 1992 and in 1993.

Because of the depleted domestic nonferrous metals ore reserves and small crude ore production, Japan's ore and concentrate requirements for its nonferrous metals production sector had been met mostly by imports since mid-1980's. To secure a steady supply of its raw materials requirements, Japan's major nonferrous metals mining and trading companies had been jointly involved in negotiating with overseas suppliers to import nonferrous metal ore and concentrate by signing short- and long-term contracts or by financing agreements through loans. These companies had also been actively seeking a long-tern supply of nonferrous minerals from overseas by directly investing in the exploration and development of a major mining property as a partner.

Japan's major overseas investment projects through equity participation in the past years for copper, in alphabetic order of country, were the Northparkes in Australia, La Escondida and La Candelaria in Chile, El Roble in Columbia, the Morenci and Chino in the United States. Japan's major overseas investment projects through equity participation for lead, silver, and zinc, in alphabetic order of country, were the McArthur River in Australia, the Tizapa in Mexico, and the Huanzala in Peru.

The major nonferrous metals mining companies involved in overseas investment projects through equity participation in exploration and development of nonferrous metals mines in the past years were Dowa Mining Co. Ltd., Mitsui Mining and Smelting Co. Ltd., Mitsubishi Materials Corp., Nippon Mining and Metals Co. Ltd., Nittetsu Mining Co. Ltd., and Sumitomo Metal Mining Co. Ltd. The major participating trading companies were Itochu Corp., Marubeni Corp. Mitsubishi Corp., Mitsui & Co., and Sumitomo Corp.

To raise the percentage share of importing through direct equity participation in overseas mineral exploration and development projects, Japan's major nonferrous metal mining companies had increased their overseas investment in exploration for and development of copper, lead, silver, and zinc in 1995.

In March 1995, Sumitomo Corp. and Newmont Gold Co. of the United States announced that they will jointly develop a large copper and gold deposit at the Batu Hijau on Sumbawa Island in Indonesia. The $1.5 billion project involved development of an open pit mine, a mill, and related infrastructure in 3 years. Under the project plan, the mill will have a capacity to produce 245,000 t/yr of copper and 15,600 kilograms per year of gold in concentrate for more than 20 years. The project will be 45% owned by Newmont Gold, 35% by Sumitomo, and 20% by P.T. Pukuafu Indah of Indonesia.[9] However, information on the project financing and the date of actual construction work was not available.

In April 1995, Sumitomo Corp. agreed to help finance a $72.4- million Mount Polley copper and gold project in central British Columbia, Canada, by paying $60.3 million to Imperial Metals Corp. of Vancouver. In return, Sumitomo Corp. was to have a 35% equity interest in the project and the rights to market the products. Ore reserves at the Mount Polley deposit were estimated at 231 Mt, averaging 0.26% copper and 0.35 g/t of gold. Mine development was scheduled to start in 1997.[10]

In December 1995, a consortium of Mitsui Mining and Smelting, Mitsui & Co., and Nippon Mining and Metals reached an agreement to acquire 12% equity interest in Compania Minera Dona Ines de Collahuasi S.A. in Chile from Falconbridge Ltd. of Canada and Minorco S.A. of Luxembourg for $195 million. The Japanese consortium agreed to buy, under a long-term contract with a $6.8-million premium, 250,000 t/yr of copper concentrate, or about one-third of the output from the Collahuasi copper project in northern Chile. Additionally, Mitsui & Co. agreed to provide $200 million in customer financing for the project. Ore reserves at the Collahuasi deposit were estimated at 1,400 Mt, averaging more than 1% copper within a resource of 3,200 Mt, averaging 0.82% copper. The $1.75-billion project was scheduled to come on-stream in late 1998 with an initial capacity to produce 330,000 t/yr of concentrate and 50,000 t/yr of refined copper using the SX-EX technology.[11]

In 1995, Dowa Mining, which has a 39% equity interest in the Tizapa lead-silver-zinc project in Mexico, planned to double the mining capacity of lead and zinc after spending $1 million for exploration to confirm additional ore reserves in the surrounding areas of the Tizapa Mine. Dowa Mining also signed a long-term contract with Prime Resources Inc. of Canada to import zinc concentrate from the KS Creek Mine in British Columbia. The mine came on-stream in August 1995.

The McArthur River project in Australia, in which Nippon Mining and Metals, Mitsui, Mitsubishi Materials, and Marubeni jointly had a minority interest, came on-stream in September 1995 and began shipping the lead and zinc concentrates to Japan. The Northparkes project in Australia, in which Sumitomo Metal Mining and Sumitomo Corp. had a minority interest, came on-stream in late 1995 and was expected to ship its copper concentrate to Japan beginning in 1996.

Nittetsu Mining launched a project feasibility study in June 1995 to develop a copper mine in the Los Bronces area south of Copiapo in Chile. According to MMAJ, the 1994 preliminary survey by MMAJ showed that all 10 drilling in the Los Bronces area intersected mineralization of over 3 meters (m) in length, averaging 1.6% copper. Ore reserves in the Los Bronces area were estimated at 15 Mt.

In late 1994, MMAJ and Mitsui Mining and Smelting jointly began exploring for lead and zinc in the Pallca area north of Lima near the Huanzala Mine in Peru. Over the past 2 years, it was expected to spend about $2 million for the exploration. In June 1995, Mitsui Mining and Smelting signed a contract with a local owner to purchase 100% ownership of the Pallca property for $1.4 million following 3-year annual payment of $300,000.

In 1995, MMAJ and Mitsui Mining and Smelting were jointly exploring for copper in the Quechua area of Cuzco Province in Peru. In late 1995, MMAJ announced that it had discovered a promising mineralized zone of copper in the northern part of Quechua, where Mitsui Mining and Smelting had held mining rights. According to MMAJ, a significant copper mineralization was discovered from 17 m below surface stretching 230 m long, averaging 0.44% copper including a 29.3-m wide high-grade zone, averaging 0.91%. This new discovery is near the southern part of Quechua, where about 100 Mt of resources, averaging 0.84% copper had been estimated by MMAJ following its exploration in the 1970's. Mitsui Mining and Smelting, which had mining rights to both areas, planned to conduct a feasibility study to develop an open pit mine by year 2000.[12]

Japan remained the world's largest importer of copper ore and concentrate, accounting for 56% of the total copper concentrate traded in the world market in 1995. Japan's imports of copper concentrate increased 10.6% to 3,825,212 t in 1995. The top seven overseas suppliers of copper concentrate to Japan were Chile, 28%; Indonesia, 18%; Canada, 17%; Papua New Guinea, 10%; the Philippines, 7%; Australia, 6%; and the United States, 5%. Because of reduced smelter production, imports of lead ore and concentrate dropped by 29.6% to 164,819 t in 1995. The top three overseas suppliers were Australia, 36%; Peru, 25%; and the United States, 13%. Imports of zinc ore and concentrate rose by 8.1% to 1,072,653 t in 1995. The top three overseas suppliers were Australia, 56%; Peru, 14%; the United States, 11%.

Production of refined copper rose slightly in 1995 reflecting the continued upward trend in domestic demand and strong demand for refined copper in the Asian market. Production of refined lead decreased resulting from the shutdown of the Naoshima lead smelter by Mitsubishi Materials and the Saganoseki lead smelter by Nippon Mining and Metals in 1994. The Kamioka and the Hosokura smelters had successfully converted their facilities to secondary lead smelter by recycling batteries, and Dowa Mining also converted part of its facilities for recycling waste batteries and reduced its electrolytic lead refining operation in 1995. As a result of these changes, utilization of scrap materials (waste batteries) as raw material in the lead smelting and refining industry had increased; while use of imported ore and concentrate had decreased in 1995. Production of refined zinc declined slightly despite a higher demand by the domestic galvanizing plants.

The higher value of the Japanese yen, lower tariffs for nonferrous metals, and higher cost of production had negatively affected the profitability of lead and zinc production in Japan for the past 2 years. Because of these reasons, according to a local press report and the Tokyo-based Japan Metal Review, Nippon Mining and Metals, the parent company of Nikko Zinc Co. Ltd., had closed its 120,000-t/yr zinc plant in Mikkaichi, Toyama Prefecture, in October 1995.[13] For the same reasons, Mitsubishi Materials, Japan's third largest zinc metal producers, had decided to phase out zinc smelting and refining operations beginning in October 1995 and planned to close down its 105,600-t/yr Akita zinc smelter in Iijima, Akita Prefecture, in June 1996. The 42-year-old plant produced about 95,000 t of slab zinc, accounting for about 14% of domestic refined zinc production in 1995.[14]

To shift part of its copper smelting and refining operations overseas, Mitsubishi Materials reached an agreement in early 1995 with Freeport McMoRan Copper and Gold Inc. (FMCG) and Fluor Daniel Inc. (FD) of the United States to jointly build a $550-million copper smelting and refining complex at Gresik in East Java, Indonesia. According to the agreement, construction of the 200,000-t/yr smelter and refinery was scheduled to start in 1995 and to be completed by the second half of 1998. The smelter, which will use Mitsubishi Materials' continuous copper smelting technology, will be fed by 600,000 t/yr of copper concentrate from the Grasberg Mine in Irian Jaya. The smelting and refining complex will be run by a joint venture of Mitsubishi Materials (70%), FMCG (20%), and FD (10%).[15]

In late 1995, Sumitomo Metal Mining, Sumitomo Corp., and Itochu Corp. reached an agreement with two subsidiaries of China National Nonferrous Metals Industry Corp., Tonling Nonferrous Metals Corp. and Hong Kong based-Sharpling International Ltd. of China, to build a $200-million copper smelter in Tonling, Anhui Province. The copper smelter was scheduled to come on-stream in 1997. The copper smelter, which will be the largest in China, will have a capacity of 100,000 t/yr of copper anode and 360,000 t/yr of sulfuric acid. The joint-venture firm is 52% owned by Tonling Nonferrous Metals, 20% by Sumitomo Metal Mining, 13% by Sharpling International, and 7.5% each by Itochu and Sumitomo.[16]

Imports of refined copper increased by 9.8% to 389,760 t in 1995. The top five overseas suppliers were Chile, 35%; the United States and Zambia, 15% each; Peru, 12%; and the Philippines, 8%. Imports of refined lead rose by 40.5% to 73,560 t, and imports of slab zinc also rose sharply by 82.3% in 1995 because of the cutback in domestic metal production of lead and zinc. The top three overseas suppliers of refined lead in 1995 were China, 46,357 t; Peru, 10,701 t; and Australia, 7,995 t. The top three suppliers of zinc slab in 1995 were China, 80,790 t; North Korea, 10,650 t; and the Republic of Korea, 9,118 t.

According to MITI, domestic consumption of refined copper increased by 0.95% to 1,520,908 t in 1995 because of increased demand for production of both wire and cable and brass mill products. Demand for copper by the wire and cable sector, which accounted for 65.6% of copper consumption in 1995, rose 0.9% to 997,649 t. Demand for copper by the brass mill sector, which accounted for 33% of copper consumption in 1995, increased by 1% to 502,103 t. Exports of refined copper increased by 38.7% to 158,727 t in 1995. The major overseas buyers of refined copper were Taiwan, accounting for 43.6% of total exports, followed by the Republic of Korea and Thailand. Overall stocks of refined copper rose by 2.9% to 147,452 t at yearend 1995.

Domestic demand for refined lead increased by 0.7% to 274,866 t in 1995, of which 68.1% was for storage batteries, 16.7% for inorganic chemicals, and the remaining 15.2% was for solders and other uses. Exports of primary lead increased by 156% from 467 t in 1994 to 1,196 t in 1995. Overall stocks of primary lead increased by 70.4% to 48,183 t at the end of 1995.

Domestic demand for zinc slab increased from 609,434 t in 1994 to 638,625 t in 1995, of which 46.5% was for sheet galvanizing, 15.9% for other plating, 14.5% for brass mill products, 10.3% for zinc die-cast products, and the remaining 12.8% for inorganic chemicals and other uses. Exports of zinc slab dropped by 27.6% to 27,970 t in 1995. Overall stocks of zinc slab remained almost unchanged at 117,721 t at the end of 1995, compared with 117,374 t in 1994.

Gold and Silver.—Mine production of gold remained steady at the 9-t/yr level, while mine production of silver continued the 1994 downward trend because of reduced mine output from the Kamioka and Toyoha Mines. Gold mine production was mainly by Sumitomo Metal Mining from the Hishikari Mine in Kagoshima Prefecture of southern Kyushu. The company was working on its Yamada, Motoyama, and Yamagumi deposits in the Hishikari area and was producing about 122,000 t per month (t/m) of ore during fiscal year 1995. Silver mine production declined in 1995 mainly owing to reduced output as a co-product from the two remaining major lead and zinc mines at Kamioka in Gifu Prefecture and at Toyoha in Hokkaido Prefecture.

In domestic exploration, MMAJ announced in November 1995 that its exploration team had discovered two mineralized zones with high gold content in the Seta area of northern Hokkaido. According to MMAJ, the newly discovered zones, a lower extension of the gold-bearing quartz veins discovered in 1993, were at a vertical depth of 230 m. Sampling with a core length of 19 m taken from the two zones averaged 5 g/t of gold and 63.4 g/t of silver.

In overseas exploration, Sumitomo Corp. signed an agreement with the Government of Niger in September 1995 to conduct a 5-year feasibility study on development of gold deposits in Niger. According to the agreement, Sumitomo was given 30-year exploration and mining rights in a 750-km^2 area in Sirba, southwestern Niger. Sumitomo was expected to spend about $6 million in the next 5 years on detailed exploration and feasibility study. According to the results of a preliminary survey conducted by MMAJ in the Mbanga area of Sirba during 1992 to 1995, ore reserves in the area were estimated at 4.1 Mt, averaging 1.45 g/t of gold.

In August 1995, Sumitomo Metal Mining, through its wholly owned subsidiary, Sumitomo Metal Mining Arizona Inc., acquired the remaining 42.9% equity in Stone Boy Inc. for $2 million and became a 100% owner of the gold, lead, and zinc project in Alaska. The Stone Boy gold exploration project had been started in 1991 in the Tanana Upland region of Alaska. MMAJ had assisted Sumitomo Metal Mining to conduct geologic, geochemical, geophysical survey, and drilling in the Pogo district of the Stone Boy area, about 32 km east of Fairbanks. According to MMAJ, 9 out of 13 drilled holes intersected gold including one 200-m vein, averaging 1.1 g/t at 3 m below surface. Other holes intersected high-grade gold ranging from a 1.7-m vein 183 m below surface with an average of 221 g/t to a 6.9-m vein with 63 g/t at about 180 m below surface. Further exploration will be continued for development of a new gold mine.[17]

Because of higher yen value and increased private investment in gold, Japan's imports of gold rose by 38% to 278 t in 1995. Imports of silver also rose by 30% to 1,238 t in 1995 owing to increased domestic demand for silver by the producers of silver nitrates and electrical contacts. Japan relied on imports to meet about 60% of its gold metal demand and 35% of its silver metal demand. The major overseas gold suppliers in 1995 in decreasing order were Australia, the United Kingdom, Switzerland, South Africa, Russia, and Canada. The principal silver metal suppliers in 1995 in decreasing order were Mexico, the United States, and Peru.

Iron and Steel.—Mine production of iron sand and roasted pyrite was small and insignificant in 1995. Japan's iron and steel industry relied on imports to meet virtually all of its iron ore requirements. Imports of iron ore, including iron sand, pellet, and sinter, increased to 120.4 Mt in 1995 from 116.1 Mt in 1994. Australia, Brazil, and India remained the three dominant suppliers, accounting for 48.8%, 22.9%, and 15.2%, respectively, of total iron ore imports in 1995. Imports of pig iron, including direct-reduced iron, also increased to 2.8 Mt in 1995 from 1.8 Mt in 1994. China alone accounted for 75.5% of total pig iron imports in 1995. According to the Ministry of Finance, Japan's average import price per metric ton of iron ore increased to $25.98 in 1995 from $24.96 in 1994, and the average import price per metric ton of pig iron increased to $200.29 in 1995 from $185.46 in 1994.

To secure long-term supply of iron ore requirements from overseas, Mitsubishi Corp. reached an agreement with Cia de Acero del Pacifico S.A. de Inversiones of Chile in September 1995 to establish a 50-50 joint-venture firm to develop an iron ore mine called Los Colorados East Iron Mine, about 110 km northeast of the Algarrobo pellet plant in Huasco, Chile. According to the agreement, Mitsubishi will invest $21 million for its equity share and will provide $65 million loan to the $107-million project. According to the Tokyo-based Tex Report, ore reserves of Los Colorados Mine were estimated at 245 Mt, averaging 30% iron. Under the development plan, the iron ore mine, with a capacity of 4 Mt/yr, was expected to come on-stream in 1998. The iron ore output will feed a pellet plant at an annual rate of 4 Mt for 20 years.

Consumption of iron ore, including iron sand, pellet, and sinter by blast furnaces, increased to 123.4 Mt in 1995 from 121.5 Mt in 1994. Of the total pig iron produced in 1995, 98.9% was for steelmaking, and 1.1% was for foundry use. By the end of 1995, the total number of furnaces, including blast furnaces, electric furnaces, and other furnaces for pig iron production, was 47; however, pig iron production capacity rose slightly to 95.5 Mt/yr in 1995 from 95.2 Mt/yr in 1994.

Japan was the world's largest producer of pig iron and crude steel. Its output of pig iron and crude steel accounted for 15% and 14%, respectively, of the world total in 1995. According to the London-based Metal Bulletin, Nippon Steel Corp., which produced 26.84 Mt of crude steel in 1995, ranked the largest steelmaker in the world; NNK Corp., which produced 11.28 Mt, ranked 7th; Sumitomo Metal Industries and Kawasaki Steel Corp. each produced 10.44 Mt and equally ranked 9th; and Kobe Steel Ltd., which produced 5.53 Mt, ranked 27th in 1995.[18]

Crude steel output increased 3.4% in 1995. Of the crude steel produced in 1995, 67.7% was processed by basic oxygen furnaces and 32.3% by electric furnaces. For the steelmaking sector, according to MITI, the number of basic oxygen furnaces was reduced by 2 to 69; while the number of electric arc furnaces was reduced by 1 to 479 by yearend 1995. However, the overall crude steel production capacity increased by 2.35 Mt/yr to 149.83 Mt/yr in 1995. The industry cut its labor force by 16,030 to 255,875 workers in 1995.

In new technology development, NKK had successfully developed a top and bottom blowing converter stainless steel refining furnace at its Fukuyama Works to reduce consumption of ferrochromium in stainless steelmaking. The newly improved furnace would reduce per-unit consumption of ferrochromium (with 61% of chromium content) from the average of 40 kilograms per metric ton (kg/t) of stainless steel produced to 7.7 kg/t by using ferrochromium only in the ladle refining process for the final adjustment of the steel's chemistry. Kawasaki Steel had developed a new technology to recover valuable metals from dust generated in specialty steel mills using direct smelting reduction at its Chiba Works. According to the company, this new process would increase the metal yield from dust by 6% and enable the recycling of iron from rolling facilities.

To reduce the cost of ironmaking, Nippon Steel purchased a new iron smelting technology called Romelt from Moscow Institute of Steel and Alloys of Russia. Nippon Steel planned to build an experimental plant in Japan in 1995. According to the company, the Romelt process would reduce capital cost by 40% and production cost of hot metal by up to 20%. The process had been undergoing testing and evaluation at Novalipetsk Steel Works in Russia.[19]

Because of a moderate economy recovery, Japan's domestic demand for both ordinary steel products and specialty steel products by all end use except tanks and container makers increased considerably in 1995. According to the Japan Iron and Steel Federation, domestic demand for ordinary steel products and specialty steel products was 58.0 Mt and 10.1 Mt, respectively, in 1995, compared with 55.9 Mt and 9.8 Mt, respectively, in 1994.

Domestic demand for ordinary and specialty steel products by steel dealers was 20.8 Mt and 1.3 Mt, respectively; by construction, 14.3 Mt and 0.68 Mt, respectively; by automobile, 9.5 Mt and 2.6 Mt, respectively; by conversion and processing, 3.3 Mt and 3.6 Mt, respectively; by shipbuilding and marine equipment, 2.8 Mt and 0.1 Mt, respectively; by electric machinery and equipment, 2.4 Mt and 0.1 Mt, respectively; by tanks and containers, 2.1 Mt and 0.03 Mt, respectively; by industrial machinery and equipment, 1.8 Mt and 1.3 Mt, respectively; and by home and office appliance and other, 1.0 Mt and 0.3 Mt, respectively, in 1995.

According to the Ministry of Finance, exports of iron and steel totaled 22,988,343 t in 1995, of which pig iron was 525,744 t; ferroalloys, 70,476 t; steel ingots, 2,885 t; semifinished ordinary steel, 561,903 t; semifinished specialty steel, 68,688 t; ordinary steel products, 17,148,797 t; and specialty steel products, 4,027,039 t. Exports of iron and steel products to Asian markets totaled 17,894,026 t, accounting for 77.8% of total exports in 1995. The major buyers in Asia were China, 3,843,492 t; South Korea, 3,127,972 t; Thailand, 2,629,080 t; Taiwan, 2,585,392 t; Malaysia, 1,357,786 t; Hong Kong, 1,254,124 t; and Singapore, 1,111,255 t in 1995. Exports of iron and steel products to the United State dropped 35.8% to 2,334,209 t in 1995.

Imports of iron and steel products rose by 30.4% to 11,723,342 t in 1995. Of the total imports, pig iron was 2,775,854 t; ferroalloys, 1,869,476 t; steel ingots, 4,809 t; semifinished steels, 562,759 t; ordinary steel products, 6,143,240 t; specialty steel products, 94,942 t; and process steels and other, 272,263 t. Hot-finished hoop, hot-rolled heavy and medium plates, cold-rolled coils and sheets, and galvanized sheets were the major import ordinary steel items in 1995. In 1995, the major suppliers of ordinary steel products to Japan were South Korea, 47.7%; China, 12.6%; Taiwan, 9.9%; Brazil, 4.2%; and the United States, 3.9%.

Manganese.—Japan's only operating manganese mine, the Nodatamagawa Mine in Iwate Prefecture, was a small-scale mining operation produced only about 100 t/yr of manganese concentrate. In 1995, virtually all of its manganese ore requirements were met by imports. Imports of manganese ore increased by 5% to 1,187,025 t in 1995, of which 10,143 t was high-grade manganese dioxide ore and 1,176,882 t, metallurgical-grade manganese ore. The major suppliers of high-grade manganese dioxide ore were China, Australia, Gabon, and South Africa, providing 29%, 28%, 18%, and 10%, respectively, in 1995. The major suppliers of metallurgical-grade manganese ore were South Africa, Australia, India, and Brazil, providing 46%, 35%, 11%, and 6%, respectively, in 1995. Japan also imported 85,952 t of manganiferous iron ore, almost all of it from India. According to MITI, consumption of metallurgical-grade manganese ore by the ferroalloys industry totaled 601,632 t in 1995.

Japan was the world's leading producer of electrolytic manganese dioxide (EMD). In 1995, Japan Metals and Chemicals Co. Ltd. shut down its Takaoka plant in Toyama Prefecture. As a result, Japan's total production capacity of EMD was reduced by 18,000 t/yr to 49,000 t/yr in 1995. Tosoh Corp., Japan's top producer of EMD, operated a 24,000-t/yr plant in Hyuga, Miyazaki Prefecture. Tosoh also had a 12,000-t/yr plant, which was operated by a joint-venture firm called Tosoh Hellas A.I.C. with Mitsubishi Corp. in Salonika, Greece. This plant was capable of producing high-grade EMD for the manufacture of dry cell batteries. Mitsui Mining and Smelting Co., Japan's second largest producer, operated a 25,000-t/yr plant in Takehara, Hiroshima Prefecture. The company also had a 12,500- t/yr plant, which was operated by its subsidiary, Mitsui Denman (Ireland) Ltd. in County Cork, Ireland.

According to the Japan Association of Dry Battery Industries, domestic demand for EMD increased to 24,090 t in 1995 from 22,253 t in 1994. According to the Ministry of Finance, Japan exported 34,948 t of EMD and imported only 711 t of EMD in 1995.

Nickel.—Japan was the world's largest consumer and the second largest producer of nickel metal, including ferronickel, nickel oxide, and refined nickel in 1995. However, all of its raw material requirements for nickel metal production were met by imports. According to the Ministry of Finance, imports of nickel ore rose by 31% to 3.8 Mt in 1995. New Caledonia, Indonesia, and the Philippines were the three suppliers, providing 1,864,282 t, 1,058,995 t, and 898,077 t, respectively.

According to MITI, consumption of nickel ore by the ferroalloy industry for ferronickel production increased by 41% to 2.9 Mt in 1995. According to the Ministry of Finance, imports of ferronickel rose by 38% to 66,771 t in 1995. The major suppliers of ferronickel were New Caledonia, 36,614 t; Indonesia, 11,037 t; the Dominican Republic, 7,852 t; Russia 6,700 t; and Colombia, 2,854 t, in 1995. Imports of nickel matte rose from 82,242 t in 1994 to 88,852 t in 1995. Western Mining Corp. Ltd. of Australia and P.T. Inco of Indonesia were the two suppliers of nickel matte to Japan. Imports of nickel oxide and nickel oxide sinter were 540 t and 1,601 t, respectively, in 1995. Australia was the dominant supplier of nickel oxide and oxide sinter to Japan.

Production of refined nickel by Sumitomo Metal Mining increased in 1995 owing to a strong demand for refined nickel by stainless steel producers. Production of nickel oxide sinter by Tokyo Nickel Co. Ltd. was at full capacity in 1995. According to a local press report, Tokyo Nickel planned to spend about $5 million to expand the capacity of its Matsuzaka plant by 18,000 t/yr to 54,000 t/yr by late 1998.[20] Additional raw material will be fed by P.T. Inco of Indonesia, which was undertaking a $580 million expansion program to increase smelting capacity by 50% at its Soroako smelter in Sulawesi, Indonesia in 1995.

Japan relied on imports to meet 79.7% of its domestic requirements for nickel metal, including cathode, powder, and flakes in 1995. Imports of nickel cathode were 61,698 t, imports of nickel powder and flakes were 4,882 t, and nickel waste and scrap were 6,444 t in 1995. The major suppliers of nickel cathode in 1995 were Russia, 23,471 t; Zimbabwe, 7,351 t; Norway, 6,952 t; Canada, 5,434 t; China, 5,092 t; Australia, 3,412 t; South Africa, 2,741 t; the United Kingdom, 2,621 t; and Brazil, 2,164 t. The major suppliers of nickel powders and flakes in 1995 were Canada, 2,804 t, and the United Kingdom, 1,465 t. In 1995, Japan exported 9,938 t of ferronickel, of which 6,295 t went to Taiwan. Exports of refined nickel rose sharply to 262 t in 1995 from 64 t in 1994.

According to MITI, domestic demand for refined nickel increased 13.5% to 83,554 t in 1995, of which 59,363 t were consumed by the manufacturers of specialty steel; 6,461 t by galvanized sheet; 4,325 t by batteries; 4,107 t by nonferrous alloys; 3,478 t by magnetic materials; 493 t by catalysts; and 5,327 t by other, including coinage and rolled sheet.

Titanium.—Japan was the world's second largest producer of titanium sponge metal and one of the world's top producers of titanium dioxide pigment in 1995. However, all of Japan's raw material requirements for production of titanium metal and dioxide pigment were met by imports. In 1995, Japan imported about 438,000 t of titanium ore, including rutile and ilmenite, and 108,000 t of titanium slag. Australia was the principal supplier of rutile; while Australia, Canada, Malaysia, and Vietnam were the major suppliers of ilmenite. Titanium slag was imported mainly from Canada and South Africa.

All of the rutile was consumed by the producers of titanium sponge metal. Ilmenite was consumed mainly by the manufacturers of titanium dioxide pigment and synthetic rutile. A small amount of rutile and ilmenite was consumed as a blast furnace additive in the steel industry. Production of titanium sponge in 1995 was by Sumitomo Sitix Corp. at Amagasaki, near Osaka in Hyogo Prefecture, and Toho Titanium Co. Ltd. at Chigasaki, about 20 km south of Yokohama in Kanagawa Prefecture. The higher level of titanium production in 1995 resulted mainly from a strong overseas demand for high-grade Japanese titanium sponge metal from Europe and the United States.

According to the Japan Titanium Society, domestic demand for titanium sponge decreased to 10,562 t in 1995 from 11,235 t in 1994; while overseas shipments of titanium sponge rose to 5,153 t in 1995 from 4,516 t in 1994. According to the Ministry of Finance, the titanium sponge exports rose from 4,634 t in 1994 to 5,370 t in 1995. In 1995, the major buyers of titanium sponge were the United Kingdom and the United States.

Production of titanium dioxide pigment increased considerably owing to higher market prices and increased demand in 1995. The 1995 output was equivalent to 81% of the industry's capacity. According to MITI, domestic shipments of titanium dioxide pigment were at about the same level as that of 1994. However, exports of titanium dioxide pigment increased by 11% to 74,480 t in 1995. The major buyers of titanium dioxide pigment in 1995 were China, the Republic of Korea, and Taiwan.

Industrial Minerals

Cement.—Japan was the world's second largest cement producer after China in 1995. Cement production decreased in 1995 owing to the low level domestic demand and reduced exports. The slowdown in building construction starts and new housing starts had resulted in a weaker domestic demand, while the high value of the Japanese yen had a negative impact on cement exports in 1995.

Japan's cement clinker capacity in 1995 was 97.6 Mt/yr with 41 plants having a total of 81 operating kilns. Production of cement clinker in 1995 was about 96 Mt. According to a report by MITI, several distribution terminals (service stations) of Sumitomo Osaka Cement and Nihon Cement in the Kobe area suffered substantial damages from the Hanshin Earthquake. However, all quake damaged distribution terminals reportedly were quickly repaired.

Because of lower cement prices in the domestic market, several major cement producers had suffered from losses. Nihon Cement Co. Ltd. was ranked Japan's largest before the mergers of Chichibu-Onoda Cement Corp. and Sumitomo-Osaka Cement K.K. in late 1994. To improve earnings, Nihon Cement planned to reduce its distribution cost by sharing distribution facilities with Mitsubishi Materials Corp. and Ube Industries to market its cement.

According to the Cement Association of Japan, domestic consumption of cement decreased to 79.6 Mt in 1995. Of the total domestic demand in 1995, 71% was for ready-mixed concrete; 14% for cement products; 5% for civil engineering works; 2% for public and private buildings; 1% for construction of roads, railroads, bridges, powerplants, and ports; and 7% for other uses.

According to the Ministry of Finance, cement clinker exports remained unchanged at 5.8 Mt in 1995; while exports of portland cement dropped to 8.0 Mt in 1995 from 8.9 Mt in 1994. In decreasing order, Malaysia, Singapore, Taiwan, and the Philippines were the major buyers of cement clinker; while, in decreasing order, Taiwan, Singapore, the Republic of Korea, and China were the major buyers of portland cement in 1995. Imports of cement was about 0.7 Mt, of which about 90% was provided by the Republic of Korea in 1995.

Limestone.—Japan was self-sufficient in limestone. Its annual output ranked the world's third largest in 1995. Production of limestone decreased in 1995, but the overall domestic demand remained relatively unchanged at 203 Mt in 1995. However, the yearend overall stocks rose to about 12.5 Mt in 1995 from 11.2 Mt in 1994.

According to the Limestone Association of Japan, the industry consisted of about 240 limestone mining companies with most of the major quarries being controlled by cement and steel companies. The gross value of limestone was estimated at more than $1.3 billion. In 1995, the leading seven limestone mining companies, in decreasing order, were Nittetsu Mining Co. Ltd., Todaka Mining Co. Ltd., Onoda Cement Co. Ltd., Ube Industries Ltd., Mitsubishi Materials Corp., Sumitomo Cement Co. Ltd., and Sumimetal Mining Co. Ltd.

According to MITI, domestic shipments of limestone declined slightly from 203 Mt in 1994 to 201.6 Mt in 1995, of which 141 Mt was consumed by the manufacturing sector; 55.2 Mt, by the construction sector; and 5.4 Mt, by other. Of the 141 Mt consumed by the manufacturing sector, 99.6 Mt was by the cement industry; 22.4 Mt, by the iron and steel industry; 9.6 Mt, by the lime industry; and 9.4 Mt, by other manufacturing industries. Of the 55.2 Mt consumed by the construction sector, 33 Mt was for concretemaking; 15.7 Mt, for road construction; and 6.5 Mt, for other construction.

Mineral Fuels

Coal.—Japan's coal production continued to fall and reached a new 93-year record low in 1995. In March 1995, after 105 years of operation, Hokutan Sorachi Coal Mining

Co. Ltd., permanently closed its 800,000-t/yr coal mine at Utashinai in central Hokkaido, and laid off all of its 562 employees.[21] In 1995, the three remaining major coal mines were Mitsui Coal Mining Co. Ltd. at Miike in Fukuoka Prefecture, Taiheiyo (Pacific) Coal Mining Co. Ltd. at Kushiro in eastern Hokkaido, and Matsushima Coal Mining Co. Ltd. at Ikeshima in Nagasaki Prefecture. According to MITI, of the total coal produced in 1995, 46% was from the Hokkaido area and 54% was from the Kyushu and Honshu areas. The industry's employment declined by 507 to 2,695 workers at the end of 1995.

Japan was the world's largest coal importer in 1995. Because of reduced domestic production and increased consumption by the iron and steel and electric power industries, coal imports increased by 5.3% to 122.4 Mt in 1995. In 1995, Japan relied on imports to meet 95% of its coal requirements. According to MITI, imports of coking coal increased from 63.2 Mt in 1994 to 65.3 Mt in 1995. The major suppliers of coking coal in 1995 were Australia, 31.5 Mt; Canada, 15.1 Mt; the United States, 7.6 Mt; and Russia, 3.0 Mt. Imports of anthracite rose from 3.1 Mt in 1994 to 3.4 Mt in 1995. The major suppliers of anthracite in 1995 were China, 1.9 Mt; and Vietnam, 1.1 Mt. Imports of steam coal increased from 49.9 Mt in 1994 to 53.7 Mt in 1995. The major suppliers of steam coal in 1995 were Australia, 32.4 Mt; China, 5.6 Mt; Indonesia, 3.4 Mt; the United States, 3.1 Mt; and South Africa, 2.9 Mt.

According to MITI, overall consumption of coal increased by 4.7% to 129 Mt in 1995 owing to the continued growth in demand for steam coal by the electric power industry in 1995. Demand for steam coal by the electric power industry grew by 9.8% in 1995. In 1995, demand for coal by the iron and steel industry was 62.9 mt; by the electric power industry, 40.8 Mt; by the coke industry, 4.7 Mt; by the cement and ceramics industries, 9.7 Mt; by other manufacturing industries, 10.4 Mt; by the gas industry, 278,000 t; and by other industries, 71,000 t. Of the total coal consumed in 1995, 122.4 Mt was imported coal, and only 6.4 Mt was domestically produced coal.

Petroleum and Natural Gas.—Japan was the world's largest importer of natural gas and crude petroleum. Its domestic production of natural gas and crude petroleum was very small when compared to its huge requirements for crude petroleum including refined petroleum products and natural gas in the form of LNG. Domestic production of both crude petroleum and natural gas declined in 1995. Consumption of crude petroleum and natural gas remained steady at 1,528 million barrels (Mbbl) and at 67 billion cubic meters (m^3), respectively, in 1995.

To meet the domestic demand, according to MITI, Japan imported 1,678.3 Mbbl of crude petroleum in 1995. Imports of natural gas, in the form of LNG, reached a record high at 64 billion m^3 in 1995. Imports of refined petroleum products, which included diesel, gasoline, heavy fuel oil, jet fuel, kerosene, and naphtha, also rose by 11.8% to 224.5 Mbbl because of increased domestic demand for all refined petroleum products, except heavy fuel oil types B and C, in 1995.

Crude petroleum imports in 1995 were mainly from the Middle East region, accounting for 78.6%, compared with 77.1% in 1994; and Asia, including China, accounting for 18.1%, compared with 19.2% in 1994. The major suppliers of crude petroleum in 1995 were the United Arab Emirates, 26.9%; Saudi Arabia, 19.4%; Iran, 8.6%; Indonesia, 7.9%; Qatar, 6.4%; Oman, 6.3%; Neutral Zone, 5.3%; China, 5.1%; and Kuwait, 4.8%. Imports of LNG totaled 42.2 Mt in 1995, of which Indonesia supplied 17.3 Mt; Malaysia, 7.9 Mt; Australia, 6.7 Mt; Brunei, 5.6 Mt; the United Arab Emirates, 3.9 Mt; and the United States, 1.3 Mt.

Demand for refined petroleum products increased by 2.4% to 1,529.7 Mbbl in 1995. Japan's net import reliance of refined petroleum products was 14.7% in 1995. In 1995, gasoline consumption rose by 2.0% to 321.6 Mbbl; naphtha increased by 13.7% to 279.2 Mbbl; jet fuel rose 12.2% to 30.3 Mbbl; kerosene increased by 4.6% to 184.3 Mbbl; and diesel rose by 2.5% to 282.9 Mbbl; however, heavy fuel oil, including types A, B, and C, dropped by 4.8% to 431.1 Mbbl. In 1995, consumption of domestically produced natural gas totaled 2.7 billion m^3, of which 41% was consumed by the gas industry, 25% by the electric power industry, 16% by the chemical industry, 15% by the oil and gas industries, and 3% by other manufacturing and service industries. Additionally, Japan consumed 42.8 Mt, or 64.1 billion m^3, of imported natural gas in the form of LNG in 1995, of which 72% was consumed by the electric power industry for power generation, 27% by the city gas industry for household use, and 1% by the iron and steel industry for steelmaking.

In overseas oil and gas exploration, Japan Vietnam Petroleum, a joint-venture firm of Mitsubishi Oil Corp., Mitsubishi Corp., and Mitsubishi Petroleum Development Co. Ltd., in partnership with Vietnam National Petroleum Corp., announced in July 1995 that it had discovered a second oil and gas field called Phuong Dong Field, about 19 km northeast of the Rang Dong Field discovered in 1994 in Block 15-2. The second exploratory well tested for oil and gas output of 1,100 barrels per day (bbl/d) of crude petroleum and about 227,000 m^3 of natural gas. The company and its Vietnamese partner were assessing the two fields for possible commercial production.

In July 1995, Mitsui & Co., Mitsui Oil Development, and Indonesia Oil, a Japanese oil development company in which Japan National Oil Corp. had 50% equity, jointly acquired 40% equity interest in an offshore oilfield from Anporex of Australia. The acquisition was the first for Mitsui & Co. to directly participate in crude oil production overseas. The oilfield, about 65 km off Dampier in Western Australia, was producing 16,000 bbl/d of oil and was expected to reach 36,000 bbl/d at the peak time. The three Japanese companies were expected to participate in development of additional oilfields near the acquired oilfield with additional cost. Japan was expected to import most of the output from the oilfields.[22]

Reserves

Japan's ore reserves for limestone and other industrial minerals, such as iodine, pyrophyllite, and silica stone, are large and of world significance. With the exception of gold and zinc, its ore reserves for other minerals, especially oil and gas, and metallic minerals are very small. *(See table 3.)*

Infrastructure

Japan has one of the world's most modern and complete infrastructures for its mining and mineral processing industry. Despite its small land area, Japan has a highway system of 1.1 million km, of which 68% is paved, and a railroad network of 27,327 km, of which 25,315 km is 1.067-m narrow gauge. Both highway and railroad networks link not only all major seaports and coastal cities on four major islands, but also connect Honshu (the main island) to the islands of Shikoku and Kyushu in the south and Hokkaido in the north via bridges and tunnels.

Japan's domestic and international telecommunication services are among the best in the world with five satellite earth stations as well as submarine cables to China, the Philippines, Russia, and the United States. For electric power transmission, Japan has a route length of 87,500 km and a circuit length of 152,000 km. For power distribution, Japan's total length of line distances, including high- and low-voltage, was 1,130,100 km concentrating in the major industrial areas of Fukuoka, Hiroshima, Nagoya, Osaka, Takamatsu, Tokyo, and Toyama. Japan also has an extensive pipeline system composed of 1,800 km for natural gas, 84 km for crude petroleum, and 322 km for refined petroleum products.

Japan has 25 major ports and more than 2,000 minor ports to receive raw materials from overseas and export manufactured products. The major port facilities, including the terminals and warehouses, are among the most indispensable infrastructure for the mineral industry because of their role in receiving imported raw materials, such as coal, iron ore, nonferrous ore, phosphate rock, crude petroleum, and LNG for mineral processing plants and powerplants as well as exporting value-added mineral and metal products. The important seaports of the major mineral-processing centers were Akita, Amagasaki, Chiba, Hachinohe, Higashi-Hamrima, Himeji, Hiroshima, Kawasaki, Kinuura, Kobe, Kushiro, Mizushima, Moji, Nagoya, Osaka, Sakai, Sakaide, Shimizu, Tokyo, and Yokohama in Honshu; Fukuoka, Kita Kyushu, and Oita in Kyushu; and Muroran and Tomakomai in Hokkaido.

The Kobe port, the world's fourth largest, its facilities, such as berths and warehouses, along with eight-lane superhighway (Route 43), bridges, railroads, powerlines, and communication system in the surrounding areas had been severely damaged by the Hanshin earthquake in January 1995. However, the City of Kobe, with financial assistance of the Central Government, had quickly repaired most of the damages. By the end of 1995, the Port of Kobe was 80% operational. However, restoration of superhighway Route 43, which connects highways from north to the south, was expected to take 2 to 3 more years.

Japan has 175 airports, of which 173 were with permanent-surface runways. The major international airports were Fukuoka, Haneda (Tokyo), Kansai, Nagoya, Narita (New Tokyo), and Osaka. Japan's first round-the-clock Kansai International Airport opened in September 1994 on an offshore reclaimed land in Osaka Bay and was operating smoothly in 1995.

Outlook

The nonferrous-metal-mining and coal-mining sectors were expected to hold steady in 1996, as the industry was about to complete its restructuring program. Mining activities of industrial minerals, such as limestone and silica stone and sand, were expected to increase in 1996 as the Japanese economy begins to recover and the construction activity moves into a higher gear. Mine production of copper, lead, and zinc was expected to remain at the 1996 level. The remaining two major nonferrous metal mines and one major gold mine in the Prefectures of Gifu, Hokkaido, and Kagoshima were expected to continue operating in 1996. Coal output was expected to be between 5.5 Mt and 6 Mt after Hokutan Sorachi Coal Mine stopped production at Utashinai, Hokkaido, in March 1995.

The outlook for the mineral-processing sector was not bright because of the high value of the Japanese yen, the high cost of production, and the reduced tariff on import metals. Metal production of lead and zinc was expected to decline further because of shrinking production capacity and lower import tariffs on nonferrous metals. However, production of crude steel was expected to remain steady at about 100 Mt in 1996 because of an anticipated upward trend in the automobile and construction industries in 1996.

As a result of decreasing domestic mine production of nonfuel minerals and mineral fuels, imports of coal, nonferrous minerals, and metals are expected to increase with the continuing recovery of the Japanese economy in 1996. In line with its mineral policy to secure and diversify its long-term supply of raw materials to ensure a steady economic growth, Japan was expected to continue its active search for direct investment in joint exploration and development of minerals in both developed and developing countries, especially in Australia, Canada, Chile, China, Peru, Mexico, and the United States. The targeted minerals were coal, crude petroleum, base metals, antimony, chromium, columbium (niobium), gold, lithium, manganese, molybdenum, natural gas, nickel, rare earths, silver, strontium, tantalum, titanium, tungsten, and vanadium.

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[1] Where appropriate, values have been converted from Japanese yen (Y) to U.S. dollars ($) at the rate of Y99.8=US$1.00 in 1994 and Y102.9=US$1.00 in 1995.

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Metal Mining Agency of Japan
Tokiwa Building, 1-24-14
Toranomon, Minato-ku, Tokyo 105, Japan
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Geological Survey of Japan
1-1-3 Higashi, Yatabe, Ibaraki 305, Japan
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TABLE 1
JAPAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1991	1992	1993	1994	1995 p/
METALS					
Aluminum:					
Alumina, gross weight thousand tons	438	316	327	326 r/	320 e/
Metal:					
Primary:					
Regular grades do.	32	19	18	17	18
High-purity do.	20	20	20	24	28
Secondary 2/ do.	1,096	1,074	1,006	1,175 r/	1,181
Antimony:					
Oxide	11,908	11,227	10,485	10,395	10,393
Metal	262	175	225	207	93
Arsenic (equivalent of arsenic acid) e/	500	50 r/	40 r/	40 r/	40
Bismuth	461	530	497	505	591
Cadmium, refined	2,889	2,986	2,832	2,629	2,652
Chromium:					
Chromite, gross weight e/	8,000	8,000	7,000	7,000	7,000
Metal	4,020	3,730 r/	3,297 r/	2,200 r/	900 e/
Cobalt metal	185	105	191	161	227
Columbium (niobium) and tantalum, tantalum metal e/	85	80	80	80	80 e/
Copper:					
Mine output, Cu content	12,414	12,074	10,277	6,043	2,376
Metal:					
Blister and anode:					
Primary	967,700	1,046,200	1,099,100	1,025,500	1,040,300
Secondary	117,700	128,700	85,700	96,500	128,200
Total	1,085,400	1,174,900	1,184,800	1,122,000	1,168,500
Refined:					
Primary	967,721	1,046,155	1,099,083	1,025,510	1,040,314
Secondary	108,562	114,704	89,693	93,658	147,645
Total	1,076,283	1,160,859	1,188,776	1,119,168	1,187,959
Gallium metal:					
Primary e/	6	6	6	6	6
Secondary e/	41	38	39	40	40
Germanium:					
Oxide	11	11 e/	11 e/	10	10 e/
Metal	3	3	3	2	2
Gold:					
Mine output, Au content kilograms	8,299	8,893	9,352	9,551	9,185
Metal:					
Primary do.	103,017	107,957	108,769	102,778	113,148
Secondary 3/ do.	109,000	93,700	105,000	100,000	110,000 e/
Total do.	212,017	201,657	213,769	202,778	223,148 e/
Indium metal do.	51,576	59,906	56,161	58,546	61,222
Iron and steel:					
Iron ore and iron sand concentrate:					
Gross weight thousand tons	31	40	11	3	3
Fe content do.	19	25	6	2	2
Roasted pyrite concentrate (50% or more Fe):					
Gross weight do.	224	244	92	90	86
Fe content do.	140	153	57	55	57
Metal:					
Pig iron and blast furnace ferroalloys thousand tons	79,985	73,144	73,738	73,776	74,905
Electric-furnace ferroalloys:					
Ferrochrome	270,786	267,857	204,719	192,989 r/	210,445
Ferromanganese	463,722	361,941	382,912	345,153 r/	346,977
Ferronickel	295,422	237,350	257,316	242,447	351,337
Ferrosilicon	62,362	37,656	29,084	12,208 r/	3,650
Silicomanganese	87,229	96,360	64,758	69,183 r/	64,870
Other:					
Ferrocolumbium	710	919	1,086	868	37
Ferromolybdenum	3,729	3,261	3,656	3,930	4,109
Ferrotungsten	61	71	80	68	120

See footnotes at the end of table.

TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 p/
METALS--Continued						
Iron and steel--Continued:						
Metal--Continued:						
Electric-furnace ferroalloys--Continued:						
Ferrovanadium		3,847	3,005	3,670	3,418	3,418
Unspecified		3,970	4,933	5,174	6,363	4,669
Total		1,191,838	1,013,353	952,455	876,627 r/	989,632
Steel, crude	thousand tons	109,649	98,132	99,623	98,295 r/	101,640
Semimanufactures, hot-rolled:						
Of ordinary steels	do.	87,982	78,487	79,078 r/	76,631	79,449
Of special steels	do.	16,808	14,842	14,767	15,014	16,171
Lead:						
Mine output, Pb content		18,329	18,839	16,470	9,946	9,659
Metal, refined:						
Primary		220,331	218,787	212,145	182,621	149,523
Secondary		112,100	111,374	97,307	109,641 r/	137,011
Total		332,431	330,161	309,452	292,262 r/	286,534
Magnesium metal:						
Primary		11,559	7,119	7,471	3,412	--
Secondary		17,158	12,978	13,215	19,009	16,760
Manganese:						
Ore and concentrate:						
Gross weight e/		100	100	80	100 r/	100
Mn content e/		21	21	16	20 r/	20
Oxide		58,526	54,294	56,106	54,560	60,366
Metal		4,056	3,734	3,169	2,555 r/	2,700 e/
Molybdenum metal		661	564	619	651	689
Nickel metal:						
Refined		23,658	22,038	23,108 r/	25,311	26,824
Ni content of nickel oxide sinter		22,473 r/	27,520 r/	28,812 r/	34,711 r/	36,800
Ni content of ferronickel		68,045	57,447	51,120	50,186 r/	63,600
Total		114,176 r/	107,005 r/	103,040 r/	110,208 r/	127,224
Platinum-group metals:						
Palladium metal	kilograms	1,053	986	1,183	1,277	2,174
Platinum metal	do.	988	629	661	691	730
Rare-earth oxide 4/		4,203	3,948	3,830	4,397 r/	4,615
Selenium, elemental		537	573	541	614	548
Silicon, high-purity		2,384	2,364	2,523	3,031	3,328
Silver:						
Mine output, Ag content	kilograms	170,676	178,330	136,886	133,713 r/	100,078
Metal:	do.					
Primary	do.	2,148,708	2,181,130	2,159,517	2,020,223	2,056,657
Secondary 3/	do.	126,308	130,711	143,605	162,025	150,000 e/
Total	do.	2,275,016	2,311,841	2,303,122	2,182,248	2,206,657 e/
Tellurium, elemental		57	57	47	47	43
Tin, metal, smelter		716	821	804	706	630
Titanium:						
Metal		18,945	14,554 r/	14,426	14,847	16,702
Oxide		279,054	252,479	245,992	237,956	249,290
Tungsten:						
Mine output, W content		279	347	66	--	--
Metal		4,147	3,307	3,477	3,825	4,468
Vanadium metal e/ 5/		404	245	252	300	250
Zinc:						
Mine output, Zn content		133,004	134,510	118,599	100,653	95,274
Oxide		84,932	82,334	75,203	73,888 r/	75,973
Metal:						
Primary		640,649	645,079	609,272	571,880 r/	573,912
Secondary		138,089	135,647	135,297	141,406	143,042
Total		778,738	780,726	744,569	713,326	716,954
Zirconium:						
Oxide e/		6,750	6,380	6,200	6,000	6,000

See footnotes at end of table.

TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 p/
INDUSTRIAL MINERALS						
Asbestos e/		25,000	29,500	24,900	21,000	20,000
Bromine, elemental e/		15,000	15,000	15,000	15,000	15,000
Cement, hydraulic	thousand tons	89,564	88,253	88,046	91,624 r/	90,474
Clays:						
Bentonite		554,325	534,472	517,389	484,115	478,058
Fire clay		845,867	751,661	736,503	685,390 r/	567,620
Kaolin		129,942	122,948	110,318	138,412 r/	166,338
Feldspar and related materials:						
Feldspar		88,471	72,285	71,568	56,003	65,085
Aplite		500,272	416,304	403,724	381,160	388,000
Gypsum	thousand tons	4,508 r/	4,322 r/	3,953 r/	3,873 r/	3,900 e/
Iodine, elemental		7,492	6,764	6,489	5,592	6,200 e/
Lime, quicklime	thousand tons	9,045	8,049	7,958	7,712 r/	7,871
Nitrogen, N content of ammonia	do.	1,553	1,602	1,447	1,450	1,500 e/
Perlite e/		203,000	203,000	200,000	200,000	200,000
Salt, all types	thousand tons	1,374 r/	1,405	1,378 r/	1,387	1,400 e/
Silica sand		4,343,413	3,842,984	3,882,719	3,942,368 r/	3,737,007
Silica stone	thousand tons	18,477	19,275	18,849	18,479	18,334
Sodium compounds, n.e.s.:						
Soda ash		1,103,455	1,056,803	1,055,959	1,049,676	1,049,017
Sulfate		249,817	242,771	229,346	210,950	210,000 e/
Stone, crushed and broken:						
Dolomite	thousand tons	5,318	4,854	4,755	3,831	3,773
Limestone	do.	206,839 r/	203,854	200,455	202,481 r/	201,089
Sulfur:						
S content of pyrite	do.	30	31	29	4	2 e/
Byproduct:						
Of metallurgy	do.	1,352	1,374	1,383	1,269 r/	1,360 e/
Of petroleum	do.	1,244	1,340	1,510	1,550 e/	1,500 e/
Talc and related materials:						
Talc		65,633	61,120	57,229	56,120 r/	57,269
Pyrophyllite		1,228,896	1,055,897	1,028,399	934,007 r/	946,894
Vermiculite e/		15,000	15,000	15,000	15,000	15,000
MINERAL FUELS AND RELATED MATERIALS						
Carbon black	thousand tons	793	771	702 r/	704	757
Coal:						
Anthracite	do.	7	--	--	1	--
Bituminous 6/	do.	8,046	7,598	7,217	6,931	6,263
Total	do.	8,053	7,598	7,217	6,932	6,263
Coke including breeze:						
Metallurgical	do.	45,458	42,308	41,767 r/	41,287	42,010
Gashouse including breeze	do.	1,243	1,096	1,024	705	593
Gas, natural:						
Gross 7/	million cubic meters	2,134	2,159	2,204	2,274	2,209
Marketed	do.	2,273	2,295	2,308	2,334 r/	2,315
Petroleum:						
Crude	thousand 42-gallon barrels	5,523	6,302	5,730	5,472	5,415
Refinery products:						
Gasoline:						
Aviation	do.	72	78	72	70 r/	74
Other	do.	278,883	290,913	301,782	313,523 r/	320,322
Asphalt and bitumen	do.	41,925 r/	37,273 r/	36,878	36,837 r/	36,124
Distillate fuel oil	do.	236,833	250,724	259,442	276,392	287,500
Jet fuel	do.	32,722	37,795	40,569	45,010	49,287
Kerosene	do.	153,908	163,560	169,573	171,010	171,969
Liquefied petroleum gas	do.	53,082 r/	54,798 r/	53,372	53,174 r/	57,084
Lubricants	do.	15,618	15,583	15,951	17,080	17,247
Naphtha	do.	88,636	100,649	109,178	109,821 r/	111,921
Paraffin	do.	918 r/	918 r/	804 r/	793 r/	800 e/
Petroleum coke e/	do.	950	900	900	950	950 e/
Refinery fuel and losses e/ 8/	do.	150,000	155,000	150,000	160,000	160,000

See footnotes at end of table.

TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specidied)

Commodity		1991	1992	1993	1994	1995 p/
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum:						
Refinery products:						
Residual fuel oil	thousand 42-gallon barrels	456,102	476,875	479,799	508,505	489,598
Unfinished oils e/	do.	57,000	58,000	58,000	60,000	60,000
Total e/	do.	1,566,699 r/	1,643,066	1,676,320	1,753,165	1,762,876

e/ Estimated. p/ Preliminary. r/ Revised.

1/ Table includes data available through July 9, 1996.

2/ Includes unalloyed ingot and alloyed ingot.

3/ Recovered from scrap, waste, and returned by end users.

4/ Includes oxide of cerium, eruopium, gadolinium, lanthanum, neodymim, praseodymim, samarium, terbium, and yttrium.

5/ Represents metal content of vanadium pentoxide recovered from petroleum residues, ashes, and spent catalysts.

6/ All steam coal.

7/ Includes output from gas wells and coal mines.

8/ May include some additional unfinished oils.

Source: Ministry of International Trade and Industry (Tokyo). Yearbook of Minerals and Nonferrous Metals Statistics, 1995; Yearbook of Iron and Steel Statistics, 1995; Yearbook of Chemical Industries Statisitics, 1995; Yearbook of Ceramics and Building Materials Statistics, 1995; and Yearbook of Production, Supply and Demand of Petroleum, Coal and Coke, 1995.

TABLE 2
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal		Hokutan Sorachi Coal Mining Co. Ltd. 1/	Sorachi in Utashinai, Hokkaido Prefecture	800
Do.		Mitsui Coal Mining Co. Ltd.	Miike in Omuta, Fukuoka Prefecture	2,500
Do.		Matsushima Coal Mining Co. Ltd.	Ikeshima in Sotome, Nagasaki Prefecture	1,400
Do.		Taiheiyo (Pacific) Coal Mining Co. Ltd.	Kushiro, Hokkaido Prefecture	2,200
Copper:				
Refined	metric tons	Hibi Kyodo Smelting Co. Ltd. (64% owned by Mitsui Mining and Smelting Co. Ltd., with minority ownership by Nittetsu Mining Co. Ltd. and Furukawa Co. Ltd.)	Tamano, Okayama Prefecture	174,700
Do.	do.	Mitsubishi Materials Crop.	Naoshima, Kagawa Prefecture	187,200
Do.	do.	Nippon Mining and Metals Co. Ltd. (wholly owned subsidiary of Nikko Kyodo Co. Ltd.)	Hitachi, Ibaraki Prefecture Saganoseki, Oita Prefecture	132,000 198,000
Do.	do.	Onahama Smelting and Refining Co. Ltd. (30% owned by Dowa Mining Co. Ltd., 12% by Furukawa Group Co., 49% by Mitsubishi Materials Corp., 4% by Mitsui Mining and Smelting Co. Ltd., and 5% by others)	Onahama, Fukushima Prefecture	247,200
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Besshi, Ehime Prefecture	210,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	60,000
Do.	do.	Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	38,400
Gold:	kilograms			
In concentrate		Sumitomo Metal Mining Co. Ltd.	Hishikari, Kagoshima Prefecture	9,000
Refined		Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	60,000
Do.		Nippon Mining and Metals Co. Ltd.	Hitachi, Ibaraki Prefecture	15,000
Do.		Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	30,000
Limestone		Mitsubishi Materials Corp.	Higashitani, Fukuoka Prefecture	10,000
Do.		Nittetsu Mining Co. Ltd.	Torigatayama, Kochi Prefecture, Onoda-Tsukumi and Nittetsu-Tsukumi, Oita Prefecture	28,000
Do.		Sumitomo Cement Co. Ltd.	Shuho, Yamaguchi Prefecture	8,000
Do.		Todaka Mining Co. Ltd.	Todaka-Tsukumi Otia Prefecture	14,000
Do.		Ube Industries Ltd.	Isa, Yamaguchi Prefecture	11,000
Iodine, crude	metric tons	Ise Chemical Industries Co. Ltd. (wholly owned subsidiary of Asahi Glass Co. Ltd.)	Oami-Shirasato, Ichinomya, Misaki, and Hikari,Chiba Prefecture; Kurosaki, Niigata Prefecture; and Sadowara, Miyazaki Prefecture	4,300
Do.	do.	Nippon Natural Gas Industry Co. Ltd.	Minamihinato-Shirako, Koji-Shirake, Yokoshiba, and Narashino, Chiba Prefecture	1,300
Do.	do.	United Resources Industry Co. Ltd.	Chosei and Otaki, Chiba Prefecture	1,800
Lead:				
In concentrate		Kamioka Mining and Smelting Co. Ltd. (wholly owned subsidiary of Mitsui Mining and Smelting Co. Ltd.)	Kamioka, Gifu Prefecture	4
Do.		Toyoha Mining Co. Ltd. (wholly owned subsidiary of Nippon Mining and Metals Co. Ltd.)	Toyoha, Hokkaido Prefecture	8
Refined	metric tons	Kamioka Mining and Smelting Co. Ltd. 2/	Kamioka, Gifu Prefecture	33,600
Do.	do.	Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	43,800
Do.	do.	Toho Zinc Co. Ltd.	Chigirishima, Hiroshima Prefecture	94,800
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Harima, Hyogo Prefecture	30,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd.	Kosaka, Akita Prefecture	25,200
Do.	do.	Hosokura Mining Co. Ltd. (wholly owned subsidiary of Mitsubishi Materials Corp.) 3/	Hosokura, Miyagi Prefecture	21,600
Manganese:				
In electrolytic dioxide		Mitsui Mining and Smelting Co. Ltd.	Takehara, Toyama Prefecture	25
Do.		Tosoh Corp.	Hyuga, Miyazaki Prefecture	24
Do.		Japan Metals and Chemical Co. Ltd. 4/	Takaoka, Yoyama Prefecture	18
Nickel:				
In ferronickel	metric tons	Hyuga Smelting Co. Ltd. (wholly owned subsidiary of Sumitomo Metal Mining Co. Ltd.)	Hyuga, Miyazaki Prefecture	18,000
Do.	do.	Nippon Yakin Kogyo Co. Ltd.	Oheyama, Kyoto Prefecture	13,000
Do.	do.	Pacific Metals Co. Ltd.	Hachinohe, Aomori Prefecture	56,000
In oxide	do.	Tokyo Nickel Co. Ltd.	Matsuzaka, Mie Prefecture	36,000
Refined	do.	Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	27,900
Pyrophyllite		Goto Kozan Co. Ltd.	Goto, Nagasaki Prefecture	204
Do.		Ohira Kozan Co. Ltd.	Ohira, Okayama Prefecture	132
Do.		Sankin Kogyo Co. Ltd.	Otsue, Hiroshima Prefecture	72
Do.		Shinagawa Shirenga Co. Ltd.	Mitsuishi, Okayama Prefecture	180
Do.		Shokozan Kogyosho Co. Ltd.	Yano-Shokozan, Hiroshima Prefecture	180
Do.		Showa Kogyo Co. Ltd.	Showa-Shokozan, Hiroshima Prefecture	60

See footnotes at end of table.

TABLE 2--Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Steel, crude		Kawasaki Steel Corp.	Mizushima, Okayama Prefecture and Chiba, Chiba Prefecture	16,880
Do.		Kobe Steel Ltd.	Kakogawa and Kobe, Hyogo Prefecture	8,300
Do.		NKK Corp.	Fukuyama, Hiroshima Prefecture and Keihin, Tokyo Prefecture	22,130
Do.		Nippon Steel Corp.	Oita, Oita Prefecture; Kawata, Fukuoka Prefecture; Kimitsu, Chiba Prefecture; and Nagoya, Aichi Prefecture	48,800
Do.		Sumitomo Metal Industries, Ltd.	Kashima, Ibaraki Prefecture; Kokura, Fukuoka Prefecture; and Wakayama, Wakayama Prefecture	22,140
Titanium:				
In sponge metal		Sumitomo Sitix Corp. (92.4% owned by Sumitomo Metal Industries, Ltd. and 7.6% owned by Kobe Steel Ltd.)	Amagasaki, Hyogo Prefecture	15
Do.		Toho Titanium Co. Ltd. (47% owned by Nippon Mining and Metals Co. Ltd., 20% by Mitsui & Co. Ltd., and 33% by others)	Chigasaki, Kanagawa Prefecture	11
In oxide	metric tons	Fuji Titanium Industry Co. Ltd. (24.8% owned by Ishihara Sangyo Co. Ltd.)	Kobe, Hyogo Prefecture	16,200
Do.	do.	Furukawa Co. Ltd.	Osaka, Osaka Prefecture	23,400
Do.	do.	Ishihara Sangyo Co. Ltd.	Yokkaichi, Mie Prefecture	154,000
Do.	do.	Sakai Chemical Industries Co. Ltd.	Onahama, Fukushima Prefecture	43,200
Do.	do.	Teika Co. Ltd.	Saidaiji, Okayama Prefecture	48,600
Do.	do.	Titan Kogyo Co. Ltd.	Ube, Yamaguchi Prefecture	16,800
Do.	do.	Tohken Products Corp.	Akita, Akita Prefecture	30,000
Zinc:				
In concentrate		Kamioka Mining and Smelting Co. Ltd.	Kamioka, Gifu Prefecture	50
Do.		Toyoha Mining Co. Ltd.	Toyoha, Hokkaido Prefecture	60
Refined	metric tons	Akita Smelting Co. Ltd. (52% owned by Dowa Mining Co. Ltd., 24% by Nippon Mining and Metals Co. Ltd., 14% by Sumitomo Metal Mining Co. Ltd., and 5% each by Mitsubushi Materials Corp. and Toho Zinc Co. Ltd.) 5/	Iijima, Akita Prefecture	156,000
Do.	do.	Hachinohe Smelting Co. Ltd. (20% owned by Dowa Mining Co. Ltd., 50% by Mitsui Mining and Smelting Co. Ltd., 10% each by Nippon Mining and Metals Co. Ltd. and Mitsubishi Materials Corp., and 5% each by Toho Zinc Co. and Nisso Smelting Co.)	Hachonohe, Aomori Prefecture	108,000
Do.	do.	Hikoshima Smelting Co. Ltd.	Hikoshima, Yamaguchi Prefecture	84,000
Do.	do.	Kamioka Mining ans Smelting Co. Ltd.	Kamioka, Gifu Prefecture	72,000
Do.	do.	Mitsubishi Materials Corp.	Akita, Akita Prefecture	105,600
Do.	do.	Nikko Zinc. Co. Ltd. (wholly-owned subsidiary of Nippon Mining and Metals Co. Ltd.) 6/	Mikkaichi, Toyama Prefecture	120,000
Do.	do.	Toho Zinc Co. Ltd.	Annaka, Gunma Prefecture	139,200
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Harima, Hyogo Prefecture	90,000

1/ Closed in Mar. 1995.

2/ The plant was renovated to a secondary lead smelter recycling batteries in 1995.

3/ The plant became a secondary smelter recycling batteries in 1995.

4/ Closed in Oct. 1995.

5/ Nippon Mining and Metals Co. Ltd. acquired 10% equity ownership from Mitsui Mining and Smelting Co. Ltd. in Mar. 1995. The plant was scheduled to close in June 1996.

6/ Closed in Oct. 1995.

TABLE 3
JAPAN: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Reserves
Coal 1/		844,000
Copper ore, Cu content		151
Dolomite 2/		1,200,000
Gold ore, Au content	kilograms	550,000 e/
Iodine		1,800 e/
Lead ore, Pb content		623
Limestone 3/		57,430,000
Pyrophyllite		205,000
Silica sand 4/		357,000
Silica stone 5/		1,327,000
Zinc ore, Zn content		3,245

e/ Estimated.

1/ Recoverable reserves, including 17 Mt of lignite.

2/ Average ore grade is 17.9% MgO.

3/ Average ore grade is 54.2% CaO.

4/ Average ore grade is 73.1% SiO.

5/ Average ore grade is 87.9% SiO.

Sources: Ministry of International Trade and Industry (Tokyo). Agency of Natural Resources and Energy.

THE MINERAL INDUSTRY OF

NORTH KOREA

By Chin S. Kuo

The gross domestic product of North Korea decreased again as it did in 1994 when it contracted 1.7%. There were reportedly food shortages and deteriorating infrastructure in North Korea. The country was unable to produce enough rice to sustain an already undernourished population. Poor weather, lack of fuel to run farm equipment, and soil degradation were the factors. In 1995, a flood wiped out 40% of the country's arable land. North Korea appealed to international aid groups and other countries for help. The Red Cross raised $2.7 million[1] in donations, but still needed $1.7 million to complete the initial phase of the aid program.

North Korea owed $10.6 billion to foreign lenders, of which three-quarters was owed to the Organization of Economic Cooperation and Development nations. The country was in desperate need for foreign capital and encouraged foreign investment in agriculture and light industry.

Despite the country's low-wage, disciplined work force, contract processing was the only activity in which many foreign companies could invest. Other factors such as inadequate infrastructure, weak legal protection, and lack of financial network had hindered the prospect of foreign investment. One exception was that Broken Hill Proprietary Co. of Australia had been pursuing contracts to mine for zinc and diamonds. The Government allowed the investors to take controlling equity stakes in joint ventures.

North Korea's two-way trade with the outside world fell considerably. China remained the country's largest trading partner. The United States eased trade restrictions with North Korea in January 1995 and, in addition, would allow direct telephone calls between the two nations and would permit travelers to use credit cards in North Korea. In a small easing of embargo on goods, the United States permitted imports of magnesite, which was one of the few North Korean products for which there was a large demand in the United States. Minerals Technologies Inc. of the United States was the first to sign a contract to import 100,000 metric tons (t) of magnesite and magnesia into the U.S. in 1995. North Korea also ended its embargo on U.S. goods.

North Korea planned to open its first economic free zone at the Rajin-Sonbong area in May 1995. That was effectively the only place foreigners could invest directly. South Korean and other foreign investors who invested in the economic zone would be given tax and other business privileges as incentives. The country was in need of foreign investment in telecommunication, power generation, transportation, and other infrastructure.

The development of the Tumen River project at the border of China, North Korea, and Russia was estimated to require about $20 billion over 20 years. The project involved developing an international port and free trade zone at the Tumen River delta. Environmental protection and conservation of natural resources also were being considered. The objective of the project was to foster the development of a broad trade bloc consisting of northeast China, Japan, Mongolia, North Korea, the Republic of Korea, and the Far East region of Russia.

A high-grade iron ore deposit was found off the coast of Unryl county in South Hwanghae Province. The deposit was expected to be developed in the future. It is close to the Unryl Mine, the region's largest iron ore producer. *(See table 1.)*

The country's cement production capacity was estimated at 18.6 million metric tons per year (Mt/yr). Sunchon and Sangwon are the two largest producers with capacities rated at 3 and 2 Mt/yr, respectively. About 1 Mt/yr of total cement output was exported to China, Pakistan, the Republic of Korea, and Vietnam.

North Korea has substantial reserves of magnesite estimated at 300 million tons (Mt)[2] and has been an intermittent supplier of magnesia to Japan and Europe through North Korean Magnesia Clinker Export and Import Co. Magnesite was mined mainly from deposits near Tanchon, South Hamgyang Province. Magnesite production was from two open pit mines, the larger of which is at Taehung. Capacity of dead burned magnesite production, which was based on coke, was estimated at between 1 and 2 Mt/yr. There is a magnesia plant at Tanchon. Production there was lower grade magnesia, which was mostly used by the country's steel industry.

The major coal-producing center is in South Pyongan Province where the Anju, Sunchon, Tokchon, Pukchang, Kaechon, and other coal-producing complexes are located.

North Korea produced about 70 Mt of anthracite in 1995. The country imported only 2 Mt/yr of coal from China and was expected to be self-sufficient in coal consumption. The expansion of the coal-mining sector would increase coal production by 150% in 1996. Current improvements included installation of a new conveyor system at Jangan Mine in the Pukchang complex and at planned new coal faces at Jiktong Youth Mine in the Sunchon complex. The Wonbuk Pit in the Anju complex, with four coal-cutting faces and a 1,400-meter conveyor system, went into production with a capacity of 200,000 metric tons per year.

In 1995, Shell Pacific Enterprises of the United Kingdom planned to invest $2 million to build an oil storage and supply system in the Rajin-Sonbong free economic and trade zone. The company was to lease land and construct a wharf for heavy oil.

North Korea received shipments of heavy oil from the United States and Korean Peninsula Energy Development Organization (KEDO) under a nuclear pact. The first shipment of 50,000 t was delivered to Sonbong port in January, and the second shipment of 100,000 t in October. The interim oil supplies were to reimburse North Korea for the energy lost by its frozen nuclear program.

The country and KEDO agreed to build two light-water nuclear reactors. The first was to be completed by 2003 under the $4.5 billion project. KEDO planned to provide North Korea with a 20-year interest-free loan.

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[1] Where necessary, values have been converted from Korean won (W) to U.S. dollars at the rate of W2.15=US$1.00 for 1995.

[2] Industrial Minerals, Feb. 1996, p. 43.

Major Source of Information

Central Institute of Mining Industry
Pyongyang, North Korea

TABLE 1
NORTH KOREA: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
METALS						
Cadmium metal, smelter		100	100	100	100	100
Copper:						
Mine output, Cu content		15,000	16,000	16,000	16,000	16,000
Metal:						
Smelter:						
Primary		20,000	21,000	23,000	23,000	24,000
Secondary		5,000	5,000	5,000	5,000	5,000
Total		25,000	26,000	28,000	28,000	29,000
Refined:						
Primary		19,000	20,000	22,000	22,000	22,000
Secondary		5,000	5,000	5,000	5,000	5,000
Total		24,000	25,000	27,000	27,000	27,000
Gold, mine output, Au content	kilograms	5,000	5,000	5,000	5,000	5,000
Iron and steel:						
Iron ore and concentrate, marketable:						
Gross weight	thousand tons	10,000	10,500	10,500	11,000	11,000
Fe content	do.	4,700	4,900	4,900	4,900	5,100
Metal:						
Pig iron	do.	6,500	6,600	6,600	6,600	6,600
Ferroalloys, unspecified	do.	120	120	120	120	120
Steel, crude	do.	8,000	8,100	8,100	81,000	8,100
Lead:						
Mine output, Pb content		80,000	75,000	80,000	80,000	80,000
Metal:						
Smelter, primary only		70,000	65,000	70,000	70,000	70,000
Refined:						
Primary		75,000	70,000	75,000	75,000	75,000
Secondary		5,000	5,000	5,000	5,000	5,000
Total		80,000	75,000	80,000	80,000	80,000
Silver, mine output, Ag content		50	50	50	50	50
Tungsten, mine output, W content		1,000	1,000	1,000	900	900
Zinc:						
Mine output, Zn content		200,000	200,000	210,000	210,000	210,000
Metal, primary		175,000	175,000	200,000	200,000	200,000
INDUSTRIAL MINERALS						
Barite		100,000	100,000	110,000	110,000	120,000
Cement, hydraulic	thousand tons	16,000	17,000	17,000	17,000	17,000
Fluorspar		41,000	41,000	41,000	40,000	40,000
Graphite		35,000	38,000	38,000	38,000	40,000
Magnesite, crude	thousand tons	1,600	1,600	1,600	1,600	1,600
Nitrogen, N content of ammonia	do.	550	550	600	600	600
Phosphate rock		500,000	500,000	510,000	510,000	520,000
Salt, all types		580,000	590,000	590,000	600,000	600,000
Sulfur	thousand tons	240	240	240	250	250
Talc, soapstone, pyrophyllite		170,000	170,000	180,000	180,000	180,000
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite	thousand tons	70,000	70,000	71,000	70,000	71,000
Lignite	do.	20,000	21,000	21,000	20,000	20,000
Total	do.	90,000	91,000	92,000	90,000	91,000
Coke	do.	3,000	3,000	3,000	3,000	3,000
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	8,400	8,500	8,600	8,600	8,600
Jet fuel and kerosene	do.	1,700	1,800	1,800	1,800	1,800
Distillate fuel oil	do.	7,600	7,800	7,800	7,900	7,800
Residual fuel oil	do.	4,100	4,200	4,300	4,300	4,200
Refinery fuel and other products	do.	2,200	2,300	2,400	2,400	2,400
Total	do.	24,000	24,600	24,900	25,000	24,800

e/ Estimated.

1/ Table includes data available through July 22, 1996.

2/ In addition to the commodities listed, crude construction materials such as sand and gravel and other varieties of stone presumably are produced, but available information is inadequate to make reliable estimates of output levels.

THE MINERAL INDUSTRY OF

THE REPUBLIC OF KOREA

By Chin S. Kuo

The gross domestic product of the Republic of Korea grew by more than 9% in 1995 because of increased exports and capital investment. A sharp increase in payments abroad for oil imports, fueled by rising crude oil import prices and growing domestic demand, has widened the current account deficit, which was about $8.4 billion.[1] Inflation in the country remained below 4.5%.

The Government decided to allow new entries into the oil-refining and oil product distribution sectors. It planned to liberalize prices of petroleum products and to allow local firms easier access to the oil products import and export businesses. The revision of laws would boost local firms' international competitiveness.

The Government maintained cooperation with Australia, Indonesia, and Russia to strengthen bilateral economic and business ties involving oil, gas, and other mineral resources. It planned to strengthen cooperation with Kuwait, Malaysia, Saudi Arabia, and Vietnam in a bid to maintain supplies of crude oil at stable prices.

The mining sector contributed only 1.9% to the overall industrial production. Output of coal, industrial minerals, and quarrying was more significant than that of metals. Total mine production in 1995 was 6.5% less than that in 1994. Anthracite production has steadily declined over the years. The 1995 output decreased by 23% from that of 1994. *(See table 1.)*

Russia agreed to pay back part of its huge debt in aluminum to the Republic of Korea. Russia was to supply aluminum valued at $90 million as part of a repayment plan totaling $457 million. Russia also would supply steel worth $135.2 million to contribute to paying off the debt.

The Republic of Korea would soon become the third largest consumer of gold in Asia after Japan and Taiwan. The country was estimated to have been buying 90 metric tons per year (t/yr) of gold.

The Government owns and controls some of the country's large, mineral-related enterprises. Most state-owned companies have gradually gone public, and part of the Government interest has been divested to private investors, such as Pohang Iron and Steel Co. Ltd. (Posco). Labor shortage and mine shutdowns had plagued the mineral industry. Skilled workers were needed at mines and plants, and the Government was considering importing foreign workers. *(See table 2.)*

LG Metals Corp., a primary copper producer, enlisted Mitsubishi Materials Co. of Japan and Outokumpu Oy of Finland to provide technology to increase copper cathode output at its Onsan plant, which currently has a capacity of 170,000 t/yr. LG Metals' other plant at Changhang has a capacity of 50,000 t/yr from melting scrap and blister. The plan was to increase output at Onsan to 330,000 t/yr when the expansion was completed. Construction was to start in July 1995, and commission was expected in late 1997. The Mitsubishi continuous copper smelting technology would cost $10 million. The country's copper demand was expected to grow by 4.3% to 484,200 t in 1995. Copper imports were projected to reach 260,000 t.

Posco signed a 50-50 joint-venture agreement with Cia Vale do Rio Doce (CVRD) of Brazil to build a $215-million, 4-million-metric ton-per-year (Mt/yr) pellet plant by September 1998 at Tubarao, Brazil. Posco would have the right to buy 2.5 Mt/yr of pellets, and CVRD would sell the remaining 1.5 Mt/yr mainly to other Asian countries.

The country's crude steel capacity was expanded to 38.9 Mt/yr in 1995. Further expansion to 44.4 Mt/yr was planned for 1996. Posco planned to build a new blast furnace at Kwangyang. When completed in 1998, Posco would become the world's largest steelmaker, with a production capacity of 28 Mt/yr. Meanwhile, the Hyundai Group was planning an integrated steel mill with an investment of $13 million. The mill would have a production capacity of 10 Mt/yr. However, the Government opposed the construction of more steel mills because additional capacities were not necessary. In 1995, Posco produced 23.35 Mt of steel.

Posco shipped cold-rolled, hot-rolled, galvanized steel sheets to General Motors Corp. of the United States for testing for auto body panels. Japanese automakers had signed agreements to purchase steel sheets from Posco.

USS-Posco Industries, a joint venture of USX Corp. and Posco at Pittsburg, California, produced 1.46 Mt/yr of cold-rolled products. The source of its hot-band feedstock would come from an even split between Posco and USS's Gary, Indiana, Works. Major capital-spending programs in the future could be the installation of a new galvanizing line to produce a higher value downstream product and the improvement to the tin mill by installing a new annealing line.

Posco planned to sell 10% of its joint-venture steel project in Vietnam, Haiphong-based VSC-Posco Steel

Corp., to Daewoo. Posco holds 50% of the joint venture and Vietnam Steel Corp. and Haiphong city government the rest. The $56-million steel plant would have a capacity of 200,000 t/yr when completed in 1995.

Posco signed a letter of intent with China National Ferrous Metal Materials Corp. to set up a $60-million joint venture in China to produce galvanized steel products. Posco was to hold a 70% stake in the joint venture, which would have a capacity to produce 100,000 t/yr of galvanized steel products.

The Arab Co. for Special Steel awarded a consortium led by Posco Engineering and Construction Co. a $130-million contract to build a special steel plant at Sadat City in Egypt; the plant would have a capacity of 140,000 t/yr. Completion was due by early 1999.

Kangwon Industries Ltd. awarded an order to Schloemann-Siemag (SMS) AG of Germany to supply a combined billet/bloom/beam blank continuous caster for its Pohang plant. The caster would have a capacity of more than 1 Mt/yr when commissioned in May 1996. SMS also would supply descaling equipment and a complete finishing shop for its 550,000 t/yr medium sections mill.

Hyundai Pipe Co. Ltd. planned to invest $500 million in a plant to produce cold-rolled steel beginning in 1997. The company agreed to buy $220 million worth of equipment from Japanese and German suppliers. The German consortium led by SMS won orders of a continuous annealing line with a skin-pass mill and an electrolytic galvanizing line. The new plant would have an initial capacity of 1.3 Mt/yr of cold-rolled, surface-finished sheet. The company also proposed a 10-Mt/yr steel mill using the Corex process. A Corex unit could be designed to produce 3,200-metric ton-per-day (t/d) of hot metal and replace a blast furnace of similar output. Posco was to construct a Corex unit to produce 2,000 t/d at the Pohang Works.

Hanbo Steel Co. Ltd. awarded a contract to SMS of Germany for a $1.4-million, combination cold-rolling line at its Ansan Bay mill. SMS also led a consortium to install a compact strip production (CSP) thin slab casting system at Hanbo Steel. The plant with a proposed capacity of 2 Mt/yr was expected to be commissioned in late 1995. Hot strip from the CSP line would be fed into the new cold-rolling line. In another development, Hanbo Steel signed a preliminary agreement for an 80-20 joint venture with Ferrominera del Orinico (FMO) of Venezuela. Hanbo Steel would be responsible for the installation of a beneficiation plant and other facilities, while FMO would provide the project's infrastructure and raw materials.

Sammi Steel Co.'s subsidiary, Sammi Atlas Inc. in Toronto, Canada, would install an argon-oxygen refining facility at Welland, Ontario. The $15-million project was expected to be completed by June 1996. The Atlas specialty steels division produces stainless, tool, and other specialty products in ingot, blooms, billets, bars, and forgings.

Korea Zinc Ltd. and its affiliate, Youngpoong Corp., relied on MIM Holdings Ltd. of Australia for about 10% of the imported 600,000 t/yr of zinc concentrate. In May, MIM Holdings declared force majeure on zinc and bulk concentrate contracts from its idle Mount Isa base metals mine in Queensland, Australia. However, the Korean smelters were not affected. Korea Zinc boosted zinc output at its Onsan plant by 10,000 to 200,000 t/yr to meet domestic demand. Youngpoong produced 80,000 t/yr to reach a total of 280,000 t/yr in 1995.

Korea Zinc's Australian unit was considering to build a $332-million electrolytic zinc smelter/refinery in Queensland. Construction of the plant was expectd to start early 1996. The plant with a capacity of 160,000 t/yr would begin production in March 1998. The company currently has only minor mining and refined chemical operations in the United States and Canada. It agreed to purchase the zinc smelter, Big River Zinc Corp. of the United States, for $52.5 million. Big River has a smelting capacity of 80,000 t/yr of zinc.

Korea Zinc and Inco Ltd. of Canada entered into a joint-venture agreement to conduct a detailed engineering study to develop a nickel project at Barro Alto, Brazil. The deposit was reported to contain 36 Mt of proven and probable lateritic ore reserves grading 1.94% nickel.[2] The proposed plant was designed to have a production capacity of 181,000 t/yr of nickel in matte. The product would be sold in the Asian market. Under the agreement, Korea Zinc and its affiliates have an option to acquire up to 49% of the joint venture.

Tong Yang Cement Corp. planned to invest $3 million in a 10,000-t cement silo project in North Korea's Rajin-Sonbong area. The company also agreed to set up cement distribution facilities in the area.

Dong Ah Stone Co. Ltd. planned to double production of pink granite. Production expansion was planned from 50,000 cubic meters (m^3) per month to 80,000 m^3 per month, with final increase to 100,000 m^3 per month. The quarry has a mine life of at least another 20 years.

Korea Gas Corp. signed a letter of intent with Liquefied Natural Gas Co. of Oman to purchase 3 Mt/yr of liquefied natural gas (LNG) for 25 years beginning in the year 2000. It also received first LNG shipment from Malaysia LNG, a unit of Petronas of Malaysia, at the Pyongtaek LNG terminal. Under the agreement, Malaysia LNG would supply 2 Mt/yr of LNG for 20 years. Korea Gas also signed a $3.3-billion contract with Pertamina of Indonesia to purchase an additional 1 Mt/yr of LNG for 20 years. Korean and Russian business leaders agreed to jointly explore and develop a gasfield in Irkutsk, Siberia. The agreement called for the Koreans to form a consortium and to conduct a feasibility study with Russians, which was scheduled to begin in late August, 1995.

Honam Oil Refinery Co. started shipping 50,000 t of distillate fuel oil to North Korea as part of a United States-North Korean agreement to suspend North Korea's suspected nuclear weapons program. The shipment was made from Yochon, South Cholla Province, to Sonbong, North Hamkyong Province, North Korea. Yukong Ltd. also won a contract to ship 40,000 t of Bunker-C fuel oil to North Korea beginning in August. Chinese tankers would carry the fuel oil from Ulsan to Sonbong, North Korea.

The country relied heavily on imports from the Middle East for most of its crude oil. Ssangyong Oil Refining Co. started operating a new crude distillation unit at Onsan. The unit was to have a crude refining capacity of 200,000 barrels per day (bbl/d). The country's five oil refiners reported a surge of 20.9% in combined sales for 1995. The purchase of naphtha and benzene by petrochemical firms increased sharply because of strong demand for petrochemical products. Some refiners planned to become exporters of gasoline to Japan in 1996. Gasoline demand was forecast to grow an average of 12.8% per year from 160,000 in 1995 to 181,000 bbl/d by 1997. Refining capacity expansion was forecast to reach 2 million bbl/d in 1996. Gasoline imports totaled 44,000 bbl/d in 1995.

Petroleum Development Corp. (Pedco) made its third oil and gas strike off Vietnam's southeastern coast in the Nam Con Son Basin in May, 1995. Pedco was operator in the block for a consortium that includes Daewoo, Hyundai, Samsung, and Shell Exploration. In April, Pedco found oil and gas in its second test well in the block.

Yukong Ltd. planned to build an oil refinery at Shenzhen, China. The company was to hold 90% of the refinery with a capacity of 100,000 bbl/d, and the parent, Sunkyong Ltd., would take up the rest. The refinery was to begin operation in the year 2000. According to Chinese regulations, the output from the refinery with 100% foreign equity would be exported. Yukong Ltd. (25%) also would take part in an oil exploration project at an offshore field in the Bangko block, Sumatra, Indonesia, with Santa Fe Resources Bangko (75%) of the United States. The exploration program would last 6 years and might be extended to 10 years.

Pedco (12.5%) and Yukong Ltd. (12.5%) joined Marathon Oil Co. of the United States in exploring for oil and gas in the South China Sea. Marathon Oil signed a deal with China National Offshore Oil Corp. to explore a block covering 4,600 square kilometers. Test drillings were scheduled for the block until 1999. The two Korean firms also were separately launching seismic studies in the block off Shanghai.

Korea Electric Power Co. awarded equipment contracts worth $200 million to Swedish-Swiss conglomerate, Asea Brown Boveri (ABB), for new units of the Yonggwang nuclear powerplant. ABB helped build two other units at Yonggwang in the past.

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[1] Where necessary, values have been converted from Korean won (W) to U.S. dollars at the rate of W771 = US$1.00 for 1995.

[2] Inco Media Information, Apr. 27, 1995, p. 1.

Major Sources of Information

Korea Institute of Geology, Mining, and Materials
  30, Kajungdong, Yusongku, Taejon
Ministry of Trade, Industry and Energy
  1, Chungang-dong, Kwach on, Kyonggi, Seoul

Major Publications

Economic Planning Board, Seoul:
  Monthly Statistics of Korea.
Korea Energy Economics Institute, Seoul:
  Yearbook of Energy Statistics.

TABLE 1
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
METALS						
Bismuth, metal		42	9	5 e/	– e/	–
Cadmium, smelter e/		450	620	400	400	400
Copper:						
Mine output, Cu content e/		5 2/	4	5	5	31 2/
Metal:						
Smelter e/		202,000	210,000	220,000	224,000	223,000
Refined, primary		201,911	209,000	218,000 e/	244,169	234,895 2/
Gold, metal	kilograms	20,809	23,263	25,000 e/	12,332	28,036 2/
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	222	222	219	191	190
Fe content	do.	134	134	122	107	106
Metal:						
Pig iron	do.	18,510	19,323	22,000 e/	21,169	22,344 2/
Ferroalloys:						
Ferromanganese		94,893	85,867	100,630	120,020	118,798 2/
Ferrosilicon		18,912	18,198	55	–	–
Ferrosilicomanganese		74,173	82,582	81,996	89,023	97,785 2/
Other		–	–	2,748	3,084	3,264 2/
Total		187,978	186,647	185,429	212,127	219,847 2/
Steel, crude	thousand tons	26,001	28,054	33,026	33,745	36,772 2/
Lead:						
Mine output, Pb content		12,633	13,628	7,409 r/	2,173	4,064 2/
Metal, smelter		40,554	63,000	88,000 e/	86,457	129,744 2/
Molybdenum, mine output, Mo content		144	5 r/	– e/	2 e/	2
Silver, metal	kilograms	264,746	332,791	214,583	257,498	342,986 2/
Tungsten, mine output, W content		780	247	200 e/	– e/	–
Zinc:						
Mine output, Zn content		22,039	21,883	13,808 r/	7,122	7,747 2/
Metal, primary		254,050	253,000	272,000 e/	271,110	279,335 2/
INDUSTRIAL MINERALS						
Asbestos e/		1,500	2,308 2/	2,200	2,000	1,800
Barite		1,014	40	– r/	85	80
Cement, hydraulic	thousand tons	34,999	44,444	47,313	50,730	55,130 2/
Clays, kaolin		1,755,225	1,856,157	2,328,921	2,675,485	2,792,139 2/
Diatomaceous earth		91,126	76,775	67,324	82,738	81,303 2/
Feldspar		247,969	281,083 r/	321,964 r/	319,658	320,000
Fluorspar, metallurgical-grade		290	70	50	50 e/	50
Graphite, all types		76,791	8,412 r/	5,910 r/	4,300	1,938 2/
Kyanite and related materials, andalusite		14	38	30 e/	30 e/	20
Mica, all grades		5,127	7,732	7,500 e/	37,470	43,704 2/
Nitrogen, N content of ammonia		407,297	442,482	450,000 e/	460,000 e/	470,000
Salt		695,804	771,937	750,000 e/	760,000 e/	770,000
Soda ash, manufactured e/		300,000	300,000	310,000	310,000	310,000
Stone, sand and gravel:						
Limestone	thousand tons	59,221	65,446	76,886	82,809	87,227 2/
Quartzite	do.	1,627	1,870	2,510	2,360	2,699 2/
Sand including glass sand	do.	1,354	1,266	1,117	1,452	1,718 2/
Sulfur, byproduct:						
Metallurgy	do.	229	260	263 e/	250 e/	255
Petroleum	do.	65	100	200 e/	200 e/	200
Total	do.	294	360	463 e/	450 e/	455
Talc and related materials:						
Pyrophyllite		573,208	602,580	644,890	707,951	789,994 2/
Talc		170,563	149,862	53,923	35,340	29,364 2/

See footnotes at end of table.

TABLE 1--Continued
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		231,000	247,936	300,133	310,564	323,409 2/
Coal, anthracite	thousand tons	14,850	11,135	8,845	7,438	5,670 2/
Coke e/	do.	5,600	5,600	5,800	5,700	5,700
Fuel briquets, anthracite briquets		14,996	11,069	12,000 e/	11,000 e/	13,000
Petroleum refinery products: e/						
Gasoline	thousand 42-gallon barrels	28,917 2/	30,000	38,000	37,000	38,000
Jet fuel	do.	9,700	9,700	9,800	9,800	9,800
Kerosene	do.	14,523 2/	15,000	29,000	30,000	30,000
Distillate fuel oil	do.	128,379 2/	130,000	165,000	170,000	160,000
Residual fuel oil	do.	142,443 2/	145,000	180,000	180,000	180,000
Lubricants	do.	7,500	7,500	4,200	4,000	4,000
Other	do.	18,000	19,000	17,000	18,000	19,000
Refinery fuel and losses e/	do.	4,000	4,000	4,000	4,000	4,000
Total e/	do.	353,462	360,200	447,000	452,800	444,800

e/ Estimated. r/ Revised.

1/ Table includes data available through July 23, 1996.

2/ Reported figure.

TABLE 2
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum, primary		Aluminium of Korea Ltd.	Ulsan	18
Bismuth, metal	metric tons	Korea Tungsten Mining Co. Ltd.	Sangdong	135
Cement		Ssangyong Cement Industrial Co. Ltd.	Yongwol	11,500
Copper, metal		LG Metals Corp.	Changhang	50
do.		do.	Onsan	175
Graphite		Kaerion Graphite Ltd.	Kangwon	25
do.		Wolmyong Mining Co.	do.	26
Lead, metal		LG Metals Corp.	Changhang	15 1/
do.		Korea Zinc Co. Ltd.	Onsan	100
Nickel, metal		Korea Nickel Corp.	do.	12
Steel		Pohang Iron and Steel Co. Ltd. (35% government owned)	Kwangyang	11,400
do.		do.	Pohang	9,400
Talc		Dongyang Talc Mining Co.	Chungju	NA
Tungsten, in ore		Korea Tungsten Mining Co. Ltd.	Sangdong	3 2/
Zinc, metal		Korea Zinc Co. Ltd.	Onsan	200
do.		Youngpoong Corp.	Sukpo	80

NA Not available.

1/ Closed in 1990.

2/ Closed in 1992.

THE MINERAL INDUSTRY OF

LAOS

By Chin S. Kuo

Laos, a landlocked country on the Indochinese Peninsula, was one of the least developed countries in Asia. In 1995, agriculture was predominant, while the industrial sector was severely underdeveloped. There was virtually an absence of manufacturing or extractive industries. The infrastructure was very poor, and external debt was substantial. The country is fairly rich in mineral resources such as coal, gold, gypsum, iron ore, limestone, potash, precious stones, and tin. Only gypsum, salt, and tin were being mined. Economic contribution from the mineral industry was very small but growing. *(See table 1.)*

By 1994, wide-ranging economic and fiscal reforms had been introduced to encourage private and foreign participation in economic development; in particular, the mineral and energy sectors.

Newmont Mining Corp. of the United States entered into a long-term agreement with the Government to explore for and to produce gold in an area covering 6,500 square kilometers (km^2) in the Provinces of Vientiane and Sayabouri. CRA Exploration of Australia also acquired the rights to prospect for gold over a 5,000-km^2 area in the Provinces of Savannakhet and Khammouane. Tin was currently exploited, and concentrate (50% Sn) from two tin mines was sent to Malaysia for smelting.

A lignite deposit of around 220 million metric tons[1] with low sulfur content could be exploited at Hong Sa in the northwest of the country. Coal demand and the exploitation of coal resources would depend on the requirements of the electricity sector in which private participation was encouraged. Lignite would be consumed in a 600-megawatt (MW) powerplant. The plant's partners would include the Nganthavee Group and the Laotian Government. Total project cost would be around $1 billion[2] with first power being delivered before the year 2000.

In another development, the $0.8-billion agreement between Actio Group of Thailand and the Laotian Government covered concessions to explore for, produce, and generate power from potential lignite resources in Xiengkuang Province.

Current energy development in the country was focused on a limited amount of hydroelectric potential. Generating capacity comprised 200 MW of a hydroelectric plant and 15 MW of a diesel plant. About three-fourths of Laotian electricity output was exported to Thailand. The 210-MW Nam Theun project was to be undertaken by a consortium comprising the Laotian Government (55%), MDX Power of Thailand (20%), and the Nordic Hydropower Group from Scandinavia (25%). The powerplant would come on-stream in late 1997.

The $1-billion Nam Theun II dam project in eastern Laos was initiated by Transfield Corp. of Australia, which holds 10% interest. The partners are Laotian Government (25%), state-owned Electricite de France (30%), and a Thai consortium (35%). The Electricity Generating Authority of Thailand agreed to buy output from the 680-MW plant. The hard currency from the project would aid the country's economic development. The project's environmental impact could be extensive flooding that would cover the Nakay Plateau forest lands. In addition, the number of people to be relocated by the project would amount from 3,000 to 4,000.

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[1] International Energy Agency Coal Research. Mar. 1995, p. 37.

[2] Where necessary, values have been converted from Laotian new kips (NK) to U.S. dollars at the rate of NK717=US$1.00 for 1995.

Major Sources of Information

Lao Minerals Exploration Co.
Vientiane, Laos
Department of Geology and Mines, Ministry of Industry
Vientiane, Laos

TABLE 1
LAOS: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Metric tons unless otherwise specified)

Commodity 2/	1991	1992	1993	1994	1995
Coal, all grades	5,000	7,500	10,000	10,000	11,000
Cement (from imported clinker)	7,000	7,000	7,000	10,000	10,000
Gemstones (sapphires) carats	35,000	35,000	35,000	40,000	40,000
Gypsum	76,776 3/	79,863 3/	80,000	85,000	85,000
Salt, rock	8,000	8,000	8,000	8,000	8,000
Tin, mine output, Sn content	300	300	300	200	200

e/ Estimated.

1/ Table includes data available through Aug. 28, 1996.

2/ In addition to the commodities listed, crude construction materials such as sand and gravel and varieties of stone presumably are produced, but available information is inadequate to make reliable estimates of output levels.

3/ Reported figure.

THE MINERAL INDUSTRY OF

MALAYSIA

By John C. Wu

Malaysia's tin production, once the World's largest, ranked seventh in 1995. However, its tin reserves were still the World's third largest. Malaysia was the World's second largest producer of refined tin and the World's third largest exporter of liquefied natural gas (LNG). Other important minerals produced in Malaysia were barite, bauxite, coal, copper, dolomite, gold, ilmenite, iron ore, kaolin, limestone, manganese, mica, monazite, natural gas, crude petroleum, silver, silica sand, and zirconium in 1995. *(See table 1.)*

The mining industry, which contributed about 8% to Malaysia's gross domestic product (GDP), continued to grow in 1995 owing mainly to increased production of crude petroleum and natural gas. According to Malaysia's Department of Statistics, the output of the mining sector grew 9.1% in 1995 compared with 3.6% in 1994, while Malaysia's GDP grew 9.6% in 1995 compared with 9.2% in 1994. Malaysia's GDP, in 1978 constant dollars, was estimated at $48.1 billion,[1] of which about $3.8 billion was contributed by the mining sector in 1995.

Malaysia was a net-exporter of mineral products in 1995. Malaysia exported most of its mineral products to Japan and neighboring Southeast Asian countries. Bauxite was exported mainly to Japan, Taiwan, and Thailand. All copper concentrate was exported to Japan. Ilmenite was exported mainly to France, Japan, and South Korea. Refined tin was exported mainly to Japan, the Netherlands, and South Korea. LNG and crude petroleum were exported mainly to Japan. Importance of Malaysia as one of suppliers of crude petroleum and refined tin to the United States had diminished.

In 1995, export earnings were estimated at $72.1 billion, of which about $2.6 billion was from exports of crude petroleum and about $1.2 billion was from exports of natural gas (in the form of LNG). Other major mineral export earnings were $217 million from refined tin, $58 million from copper concentrate, $10 million from ilmenite, $5 million from kaolin, and $1 million each from bauxite and mica.

Malaysia's imports of nonfuel minerals, such as iron ore and tin concentrate, were mostly reexported after smelting. However, a considerable quantity of coal, heavy crude petroleum, nonferrous metals, and industrial minerals including gypsum, phosphate rock, potash, and salt were imported annually for domestic consumption.

Malaysia continued to import about 23,000 barrels per day (bbl/d) of heavy crude petroleum from the Middle East to meet the requirement for domestic refineries. Other important mineral imports in 1995 were iron ore, tin concentrate for reexport after smelting; cement clinker, gypsum, phosphate rock, potash, sodium carbonate, and sulfur for domestic consumption.

The structure of Malaysia's mineral industry remained unchanged from that of 1994. However, a manganese mine came on-stream in the State of Kalantan. *(See table 2.)*

According to the Malaysian Department of Mines, the number of workers employed by the major nonfuel minerals at the end of November 1995 was barite, 37; bauxite, 179; copper, 1,014; gold, 486; ilmenite, 49; iron ore, 154; kaolin, 479; limestone, 234; mica, 30; silica sand, 132; and tin, 1,848. In coal mining, there were 31 workers. According to the Malaysian Ministry of Human Resources, the total number of persons employed by the mining and quarrying industry was estimated at 39,200 in 1995. Because of increased employment in the construction and manufacturing sectors, Malaysia's total labor force rose to 8.1 million in 1995 from 7.8 million in 1994, while the unemployment rate decreased to 2.8% in 1995 from 2.9% in 1994.

In mining, production of bauxite increased slightly in 1995, but was less than 50% capacity. Johore Mining and Stevedoring Co. Sdn. Bhd., Malaysia's sole bauxite producer, operated a multiple-bench, open pit mine and a washing plant with a capacity of 1 million metric tons per year (Mt/yr) of ore and a work force of 180 at Bukit Raja near Pengerang Highway north of Sungai Rengit and east of Johore Bahru. According to the company, ore reserves in the Pengerang area were expected to be depleted by 1997. The company produced three grades of bauxite from the mining area: refractory, metallurgical, and cement. Most chemical- and metallurgical-grade washed bauxite were exported to Japan and the United States, while the cement-grade bauxite was sold as raw material to domestic cement manufacturers. Exports of bauxite increased to 170,000 metric tons (t) in 1995 from 163,600 t in 1994. Export earnings from bauxite were estimated at $1 million in 1995.

Production of copper concentrate by Mamut Copper Mining Sdn. Bhd. from the Mamut Mine in Sabah decreased to 87,000 t from 107,000 t in 1994 because of depleting ore reserves. The metal content of copper, gold, and silver in the concentrate was about 19,600 t, 1,500 kilograms (kg), and 10,900 kg, respectively, in 1995, compared with 25,267 t, 2,141 kg, and 13,061 kg, respectively, in 1994. Export earnings from copper concentrate were estimated at $55 million in 1995.

Production of gold decreased significantly in 1995 because of reduced output from the Tebedu area of southwestern Sarawak and from the Mamut Mine as byproduct of copper mining. Of the total gold produced in 1995, 48% was from the Mamut copper mine in Sabah; 36% was from 10 to 12 small-scale gold mines operating in the States of Kelantan, Pahang, and Terengganu; and 16% was from 2 gold mines in Sarawak.

Following completion of an extensive drilling program, the Canadian-based Avocet Ventures Inc.(AVI) decided to develop its Penjom gold property (block 7) in central Pahang. AVI also planned to build a carbon-in-leach treatment plant with an ore throughput capacity of 500,000 metric tons per year (t/yr). The total project cost including associated infrastructure was about $17 million, of which $4 million will be from AVI's internal sources, and the remainder will be financed by a loan from the Macquaries Bank Ltd. of Australia. The project feasibility was based on ore reserves of 2.01 million metric tons (Mt) at a grade of 4.42 grams per metric ton of gold. Under the company's plan, gold production was scheduled to begin in October 1996.[2]

For gold exploration, the State Government of Pahang approved 22,700 hectares (ha) of land in 1995 and planned to open up an additional 78,600 ha of land in 1996. Since 1990, about 30 mining licenses had been approved to explore for gold in Malaysia. The major mining companies involving gold exploration in Pahang were Damar Consolidated Exploration Sdn. Bhd., Malaysia Mining Corp. Bhd., Tshu Lian Shen Mining Sdn. Bhd., Avocet Ventures Inc. of Canada, Western Resources, Valiant Consolidated Ltd., Montague Gold, Target Resources, and the Vista Development Sdn. Bhd. A joint exploration by the Geological Survey of Malaysia and the Metal Mining Agency of Japan indicated gold mineralization in South Imbak subarea of central Sabah. The joint exploration in Sabah was expected to continue in 1996.

Production of iron ore decreased slightly in 1995. According to the Malaysian Department of Mines, most of the 1995 production was from six operating mines in the States of Johor, Kedah, Pahang, and Perak. About 10% of the 1995 iron ore production was recovered as a byproduct of tin mining.

Most of the iron ore production was consumed domestically by Malayawate Steel Bhd. and several cement companies as raw material. To meet the raw material requirements for its iron and steel industry, Malaysia imported annually about 1 Mt of iron ore mainly from Bahrain, Brazil, Chile, and Sweden and between 100,000 t and 150,000 t of pig iron from China, India, Japan, Switzerland, Ukraine, and other countries. Malaysia also imported annually between 700,000 t and 1 Mt of iron and steel scrap principally from the United Kingdom and the United States. Imported iron ore was consumed by the direct reduction (DR) plants in Kemaman, Terengganu, and on Labuan Island, offshore Sabah. Pig iron and iron and steel scrap were consumed by Perwaja Steel Sdn. Bhd. (PS) and other major producers of steel billet in peninsular Malaysia.

Malaysia's iron and steel industry had a total crude steel capacity of more than 2 Mt/yr, in the form of steel billet, with two charcoal blast furnaces, eight electric arc furnaces, and two DR plants. Gunawan Iron and Steel Sdn. Bhd. (GIS), which planned to construct a steel slab plant at the Telok Kalong Industrial Estate near Kemaman in Terengganu, revised the planned capacity of its steel slab plant to 1.35 Mt/yr from 1.8 Mt/yr and postponed its startsup to mid-1998. However, GIS had completed 95% construction of a 250,000 t/yr plate mill at the Telok Kalong site. GIS planned to bring its plate mill on-stream in May 1996 and import slab feed for the mill until its own slab plant is completed in 1998.

PS, Malaysia's only integrated steel producer, was in financial difficulties. According to the Malaysia Government, PS reported a loss of $148 million in fiscal year 1995 owing to large depreciation writeoffs, high-interest payments, and frequent shutdowns at Perwaja's plants. According to Finance Ministry, since 1988, PS had an accumulated loss of about $980 million by the end of fiscal year 1995 and made a profit only in 1990.[3] As a result, PS had appointed a new managing director to review or put on hold the company's plans to expand mill capacity at Gurun, Kedah and other expansions at Kemaman, Terengganu.[4]

Malaysia's tin mining industry was stagnant in 1995. According to Malaysia's Department of Mines, the monthly output of tin averaged 533 t in 1995 compared with 538 t in 1994, although the average tin price on the Kuala Lumpur Tin Market was slightly higher in 1995 than in 1994. According to the Malaysian Chamber of Mines, the prospect of higher tin production in 1996 will very much depend upon the tin price. If the tin price were to stay at $7.00/kg or more, then Malaysia could produce about 10,000 t/yr of tin.

Of the total tin produced in 1995, 17% was by dredging, 43% by gravel pumping, 24% by open pit, 10% by panning, and 6% by amang retreatment and underground mining. The total number of operating mins increased from 39 in January 1995 to 40 in May. However, the tin mining industry's total labor force declined to 1,848 in November 1995 from 2,068 in November 1994. During 1995, there were 4 dredges, 21 gravel-pumping units, 14 open pit mines, and 2 underground mines operating.

For tin metal production, Malaysia continued to import foreign tin ore and concentrate to supplement the shortfall in domestic ore production. The ratio of foreign tin ore to domestic ore was about 80 to 20 with a total smelter's intake of 67,346 t in 1995. For the first 8 months, imports of tin-in-concentrates amounted to 24,327 t in 1995 compared with 23,877 t in 1994. To meet the growing demand for high-purity tin by the producers of electronic products in Europe and Asian, Malaysia Smelting Corp. Bhd. was expanding the monthly electrolytic refining capacity of 4N (99.99%) tin metal to 30 t from 10 t at Butterworth, Penang, in 1995.[5]

According to the Malaysian Department of Mines, domestic demand for refined tin rose to 6,370 t in 1995 from 5,614 t in 1994. Of the total domestic tin consumption, about 50% was consumed by the solder industry, 21% by the tinplating industry, 10% by the pewter industry, and 19% by others.

Malaysia's cement production reached a new high in 1995, when its economy was growing rapidly with a booming construction industry. In 1995, Malaysia's cement clinker capacity was 8.6 Mt/yr with a total cement grinding capacity of 11.9 Mt/yr. Malaysia's major cement companies operated their own limestone quarries mainly at Padang Rengas and Kinta of Perak, at Baling and Langkawi of Kedah, and at Puchong and Rawang of Selangor in peninsular Malaysia.

Malaysia's demand for cement continued to grow in 1995 because of heavy investment in the public works and commercial buildings projects in 1995. Because of a cement shortage of about 220,000 t in 1995, the Government approved a 10% increase in domestic cement price from the Government-controlled rate of about $71/t to encourage domestic cement producers to boost their output.

In early 1996, Kedah Cement Holdings Bhd. was expected to bring on stream a new 1.8 Mt/yr production line at Kangar in Perlis. Additionally, Associates Pan Malaysia Cement Sdn. Bhd. was planning to expand its plant capacity at Kantan in Perak by adding a new 2- Mt/yr kiln at a cost of $280 million. Perak-Hanjoong Simen Sdn. Bhd. and Tasek Cement Bhd. also were planning to add 1.5 Mt/yr each to their capacity by 1998.[6]

In 1995, about 78% of ilmenite was recovered as a byproduct from tin tailing treatment plants operating in the States of Perak and Selangor. The remaining 22% was produced from two operating mines in the State of Terengganu. Under an agreement signed in June, Malaysia Mining Corp. (MMC), in partnership with Vietnamese state-owned Binh Dinh Mineral Co., is to explore for ilmenite and develop a mine at Catkhanh in Quinhon, central Vietnam. The $1.8 million exploration and development project will be owned 60% by MMC and 40% by the Vietnamese company. Ore reserves at the Cathhanh ilmenite mine also contain a high percentage of monazite and zircon.[7]

Tioxide (Malaysia) Sdn. Bhd., established in 1988, began production of titanium dioxide pigment using the sulfate process at the Telok Kalong Industrial Estate in May 1992. The output of titanium dioxide pigment reached 86% of the plant capacity in 1995. The company, having a work force of 250 and capacity of 50,000 t/yr, could easily increase its plant capacity from 50,000 t/yr to 75,000 t/yr by upgrading the existing facility. Beginning in December 1994, the Malaysian Government imposed a 15% tariff on imports of titanium dioxide pigment to help Tioxide boost its Malaysia's market share to about 85%. The Government also provided a 10-year tax holiday to Tioxide.[8]

Malaysia's production of natural gas ranked 12th in the World, accounting for about 1.2% of the World's total output in 1995. Malaysia's natural gas production reached a new record owing to increased consumption by the manufacturers of LNG, nitrogen fertilizer, and petrochemical as feedstocks; and increased consumption by the power, industrial, commercial, and residential sectors as energy sources.

Production of LNG by Malaysia LNG Sdn. Bhd. was at full capacity. In 1995, all of the 10 Mt of LNG exports went to Japan and South Korea under long-term contracts. In December 1994, Petroliam Nasional Berhad (PETRONAS) signed a new 20-year contract with Tokyo Gas Co., Osaka Gas Co., Toho Gas Co., and Kansai Electric Power Co. of Japan to supply 2.1 Mt/yr of LNG to the Japanese utility companies starting in 1995. Malaysia's second LNG plant, with a capacity of 7.8 Mt/yr and under construction by a consortium led by M. W. Kellog Co. of the United States at Bintulu, was expected to come on-stream in 1996. The second LNG plant will be opreated by Malaysia LNG Dua (MLNG-2). MLNG-2 is owned by PETRONAS (60%), the State-owned oil and gas company, Shell Gas NV (15%), Mitsubishi Corp. (15%), and Sarawak State government (10%).

For exporting LNG from the second LNG plant, PETRONAS signed a 20-year contract, valued at $9 billion, with Chinese Petroleum Corp. of Taiwan to supply 2.25 Mt/yr of LNG starting in 1996. In December 1995, PETRONAS signed an agreement with Nippon Oil Co. of Japan, Royal Dutch/Shell of the Netherlands, and Occidental Petroleum Corp. of the United States to supply natural gas from gasfields offshore Sarawak to the planned third LNG plant, with a capacity of 6.8 Mt/yr, at Bintulu, Sarawak. To own and operate the third LNG plant, a joint-venture firm, Malaysia LNG Tiga Sdn. Bhd. (MLNG-3), was established. MLNG-3 is owned 70% by PETRONAS, 10% each by Nippon Oil, Royal Dutch/Shell, and Occidental Oil Corp. The future LNG production from the third LNG plant will be exported to China, India, Japan, South Korea, the Philippines, Taiwan, and Thailand beginning in 2001.[9]

Malaysia's crude petroleum production ranked 21st in the World, accounting for about 1% of the World's total in

1995. The 1995 output including condensate reached a record high of 694,300 bbl/d owing to increased output from new oilfields offshore Sarawak and Terengganu. Crude petroleum production was by PETRONAS Carigali Sdn. Bhd. (PETRONAS CAG), the upstream arm of PETRONAS, and three foreign contractors, Esso Production Malaysia Inc. (EPMI), Sarawak Shell Bhd. (SSB), and Sabah Shell Petroleum Co. Ltd. (SSP). About 57% of crude petroleum output was by EPMI and a joint venture of EMPI and PETRONAS CAG from oil and gasfields offshore Terengganu. The remaining 43% was by SSP, SSB, and a joint venture of SSB and PETRONAS CAG from oil and gasfields offshore the States of Sarawak and Sabah. In June, the joint venture of EPMI (78%) and PETRONAS CAG (22%) brought on stream the Guntong D platform with 40 wells to produce 80,000 bbl/d offshore Terengganu.

PETRONAS CAG announced that it made two new discoveries in 1995. One, in joint ventures with International Petroleum Corp. (58.6%) in the Bunga Kekwa-1, PM3 block, offshore peninsular Malaysia, tested at a combined rate of 10,212 bbl/d of oil and 5.08 million cubic meters of natural gas. Another in the Tanjung Baram-1, block SK15, offshore Sarawak, tested at a combined rate of 4,250 bbl/d of oil and 274,500 cubic meters of natural gas.[10]

Export earnings from crude petroleum were at the same level as that of 1994. Singapore, Japan, South Korea, Japan, and Thailand remained the major buyers of the Malaysia crude petroleum in 1995. Malaysia continued to import about 22,000 bbl/d of heavy crude oil in 1995 to meet the requirement for its domestic oil refineries.

In January, PETRONAS awarded a $690 million contract to build its second refinery to a consortium of Chiyada Corp. and Mitsui & Co. Ltd. of Japan, and MMC Engineering Service of Malaysia. The contract was for design, procurement, construction, and commissioning of a 100,000 bbl/d oil refinery exclusively for export in Malacca by 1997.[11]

Major Sources of Information

The Ministry of Primary Industry:
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Fax: 60-3-261-7300
Geological Survey of Malaysia
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Jalan Tun Razak, P.O. Box 11110
50736 Kuala Lumpur, Malaysia
Telephone: 60-3-261-1033
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Major Publications

Ministry of Primary Industry
Department of Mines: Statistics on Mining Industry in Malaysia, monthly and Bulletin on Mining Statistics, quarterly.
Geological Survey of Malaysia: Annual Report, and Malaysia Minerals Yearbook.
Department of Statistics: Statistical Bulletin, Malaysia, monthly; Yearbook of Statistics, Malaysia; Statistical Bulletin, Sarawak, annual; and Statistical Bulletin, Sabah, annual.

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[1] Where appropriate, values have been converted from Malaysia ringgits (M$) to U.S. dollars at the rate of M$2.62=US$1.00 in 1994 and M$2.51=US$1.00 in 1995.

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[5] South-East Asia Mining Letter (London). "Malaysia's High-Purity Tin Output to Triple." V. 8, No. 2, Jan. 26, 1996, p. 7.

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[10] Petroleum Economist (London). V. 62, No. 1, Jan. 1995, p. 36, and V. 62, No. 7, July 1995, p. 36.

[11] The Journal of Commerce. "Malaysia Awards Refinery Contract to Japanese Group." V. 403, No. 28409, Feb. 9, 1995, p. 5B.

TABLE 1
MALAYSIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 p/
METALS						
Aluminum: Bauxite, gross weight	thousand tons	376	331	269 r/	162	184
Copper, mine output, Cu content (Sabah)		25,605	28,556	25,182	25,267	21,900 e/
Gold, mine output, Au content:						
Malaya	kilograms	871	774 r/	873	1,038 r/	1,166
Sabah	do.	1,615	2,215	2,042	2,141	1,535
Sarawak	do.	291	524 r/	1,547	906 r/	460
Total	do.	2,777	3,513	4,462	4,085 r/	3,161
Iron and steel:						
Iron ore and concentrate	thousand tons	376	320	246 r/	243 r/	202
Steel, crude	do.	1,130	1,559	1,808	2,046 r/	2,300 e/
Manganese, gross weight		--	--	--	--	37,600
Rare-earth metals: Monazite, gross weight		1,981	777	407	425	814
Silver, mine output, Ag content						
Sabah	kilograms	13,262	15,076	13,663	13,061	10,900
Sarawak 3/	do.	169	250	350	281	180
Total	do.	13,431	15,326	14,013	13,342 r/	11,080
Tin:						
Mine output, Sn content		20,710	14,339	10,384	6,458	6,402
Metal, smelter		42,722	45,598	39,984 r/	38,119 r/	39,454
Titanium:						
Ilmenite concentrate, gross weight		336,347	337,744	288,950	115,885	151,680
Dioxide		--	690	22,854	36,000	43,000 e/
Tungsten, mine output, W content		2	3	2	--	--
Zirconium: Zircon concentrate, gross weight		5,579	2,608	2,184	1,656	3,790
INDUSTRIAL MINERALS						
Barite		16,600	10,525	11,551	17,144	16,966
Cement, hydraulic	thousand tons	7,451	8,366	8,797	9,928 r/	10,667
Clays: Kaolin		186,699	244,573	249,852	252,628	211,182
Mica		3,517	4,754	4,659	4,993	5,848
Nitrogen: N content of ammonia		286,200	331,100	333,700	334,000 e/	340,000 e/
Silica sand (Malaya and Sarawak)		668,244	579,491	355,389	230,756	287,515
Stone:						
Dolomite		18,115	25,400	27,800	37,700	28,100
Limestone e/	thousand tons	20,700	22,000	23,000	24,000	26,000 e/
MINERAL FUELS AND RELATED MATERIALS						
Coal	do.	64	74	264	174	112
Gas, natural: 4/						
Gross	million cubic meters	21,150	22,550	28,174	30,251	36,500 e/
Net 5/	do.	16,261	18,186	21,648	24,397	28,100 e/
Petroleum: 4/						
Crude	thousand 42-gallion barrels	238,293	240,541	235,425	238,491	253,420
Refinery products:						
Gasoline	do.	13,379	13,490	14,664	15,879 r/	18,640 e/
Jet fuel e/	do.	3,000	3,000	3,100	3,200	3,300
Kerosene	do.	6,897	7,097	8,257	12,026 r/	14,360 e/
Diesel	do.	28,026	29,421	31,458	38,490 r/	43,580 e/
Residual fuel oil	do.	13,997	13,995	15,901	14,416 r/	15,000 e/
Other e/ 6/	do.	12,500	13,000	13,000	14,000 r/	15,000
Total	do.	77,799	80,003	86,380	98,011 r/	109,880 e/

e/ Estimated. p/ Preliminary. r/ Revised.

1/ Table includes data available through May 28, 1996.

2/ In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone), fertilizers, and salt is produced, but not reported, and available information is inadequate to make reliable estimates of output levels.

3/ Byproduct from gold mines in Sarawak.

4/ Includes production from Malaya, Sabah, and Sarawak.

5/ Gross less volume of reinjected and flared.

6/ Includes LPG, naphthas, and lubricants.

Source: Ministry of Primary Industry, Department of Mines (Kuala Lumpur). Monthly Statistics on Mining Industry in Malaysia, Monthly, 1995; Quarterly Bulletin, Quarterly, 1995.

TABLE 2
MALAYSIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operation companies and major equity owners	Location of main facilities	Annual capacity
Bauxite		Johore Mining and Stevedoring Co. Sdn. Bhd. (61% owned by Aluminium Ltd. of Canada, 39% by local investers and other)	Bukit Raja-Pengerang, Johor	400
Cement		Associated Pan Malaysia Cement Sdn. Bhd. (equally owned by Malaysia Cement Bhd. and Pan-Malaysia Cement Work Bhd.)	Rawang, Selangor and Kantan, Perak	2,800
Do.		Cement Industries of Malaysia Bhd. (publicly owned company)	Kangar, Perlis	1,600
Do.		Kedah Cement Holdings Bhd. (majority owned by Bolton Bhd. and minority by general public shareholders)	Langwai, Kedah	1,500
Do.		Perak-Hanjoong Simen Sdn. Bhd. (60% owned by Korea Heavy Industries and Construction Co., and 40% by Perak State Government)	Padang Rengas, Perak	1,200
Do.		Tasek Cement Bhd. (publicly owned company)	Ipoh, Perak	1,500
Copper, concentrate		Mamut Copper Mining Sdn. Bhd. (wholly owned subsidiary of Mega First Corp. Bhd.)	Mamut, Sabah	100
Gas:				
Natural	million cubic meters per day	Esso Production Malaysia Inc.	Offshore Terengganu	22.7
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	2.8
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	38.5
Liquefied		Malaysia LNG Sdn. Bhd. (60% owned by PETRONAS, 17.5% by Shell Gas N.V., 17.5% by Mitsubishi Corp., and 5% by Sarawak State government)	Tanjung Kidurong, Bintulu, Sarawak	9,600
Petroleum, crude	million 42-gallon barrels per day	Esso Production Malaysia, Inc.	Offshore Terengganu	390
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	100
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	184
Do.	do.	PETRONAS Carigali Sdn. Bhd.	Offshore Terengganu	22
Steel, crude		Perwaja Steel Sdn. Bhd. (Government owned)	Kemaman, Terengganu	1,200
Tin:				
Concentrate		Rahman Hydraulic Tin Bhd. (privately owned company)	Klian Intan, Perak	1
Do.		Petaling Tin Bhd. (wholly owned subsidiary of Malaysia Mining Corp.)	Kuala Langat, Selangor	2
Do.		Tima Langat Bhd. (65% owned by Selangor State government and 35% by Malaysia Mining Corp.)	do.	1
Refined		Escoy Smelting Sdn. Bhd. (formerly Datuk Kermate Smelting Bhd. ehich is 50.5% owned by Amalgamated Metal Corp.,29% by Consolidated Tin Smelter Ltd., and 20% by Malaysia Mining Corp.)	George Town, Penang	20
Do.		Malaysia Smelting Corp. Bhd. (37.44% owned by The Straits Berhad Trading Co., Ltd., 37.44% by Malaysia Mining Corp., and 25.12% by other)	Butterworth, Penang	60
Titanium, oxide		Tioxide (Malaysia) Sdn. Bhd. (85% owned by Tioxide Group PLC and 15% by Terengganu State Government)	Kemaman, Terengganu	50

THE MINERAL INDUSTRY OF

MONGOLIA

By John C. Wu

Mongolia is a mineral-rich country. Over the past years, about 80 different minerals had been found in Mongolia. Of these findings, 40 different minerals had been evaluated, and about 150 deposits were being worked by the Government. Coal, copper, fluorspar, and molybdenum were mined by large-scale operations; while clay, gold, gypsum, limestone, salt, sand and gravel, silica, tin, tungsten, and uranium were mined by medium- and small-scale operations. Most of the mining operations were in the north-central and eastern parts of the country. In 1995, Mongolia was the world's fourth largest fluorspar producer and was one of the top three producers of copper and molybdenum in the Asian region.

According to the State Statistical Office of Mongolia (SSOM), the Mongolian economy, as measured by real gross domestic product (GDP), grew 6.3% in 1995 compared with 2.3% in 1994. Mongolia's GDP was estimated at $869 million.[1] Because of increased output of gold, the mining industry continued the 1994 upward trend. In 1995, the output of the mining industry accounted for about 8% of the GDP of Mongolia. Minerals exports accounted for about 50% of the Mongolia's total export earnings in 1995.

According to the Ministry of Trade and Industry, the two-way merchandise trade increased by 43.8% to $900.3 million in 1995. Export earnings rose by 39.2% to 511.6 million, while import bills also increased by 50.4% to $388.7 million in 1995. The two principal exports were minerals and cashmere. Mongolia's merchandises were exported mainly to Japan, 18.7%; Kazakstan, 15.2%; China, 14.3%; Switzerland, 13.2%; and Russia, 13.1%. The two principal import commodities were industrial goods and consumer goods. Mongolia's imports were supplied mainly by Russia, accounting for 52% of Mongolia's imports, followed by Japan, 15%, and China, 10.2%, in 1995.

According to SSOM, the major export mineral commodities in 1995 were copper concentrate, 435,900 metric tons (t); fluorspar concentrate, 114,600 t; and molybdenum concentrate, 3,438 t. The major mineral commodity imports in 1995 were ferrous and nonferrous metals, refined petroleum products, and fertilizer materials.

In mining, production of copper and molybdenum concentrates, by the Erdenet Combine, from the Erdenet Mine in Bulgan Aymag of northern Mongolia was 346,300 t and 3,906 t, respectively, in 1995. The copper concentrate contained about 30% of copper with high content of silver and selenium. The molybdenum concentrate contained about 47% of molybdenum with high content of rhenium and selenium. The Erdenet Copper Corp., the Mongolian-Russian joint-venture firm of the Erdenet Combine, is owned 51% by the Government of Mongolia and 49% by the Government of Russia.

In 1995, the Erdenet Copper had paid off its $20 million loan mainly with copper concentrate. In 1992, the company borrowed $20 million from Itochu Corp. (formerly C. Itoh & Co.) of Japan for improving the mining operation and rehabilitating the milling facilities at its Erdenet copper-molybdenum Combine.[2]

To extract copper from tailing in the mine dump and from low-grade oxide ore, ERDMIN started construction of a solvent-extraction and electrowinning (SX-EW) plant and related facilities at the Erdenet Combine in 1995. According to an official of ERDMIN, the plant was expected to come on-stream in late summer or early fall of 1996. The SX-EW plant, at the first stage, would have an initial capacity of 3,000 metric tons per year of high-purity refined copper. ERDMIN is owned 51% by the Erdenet Combine and 49% by Nescor of the United States. In 1995, RCM, Inc., the former partner of the Erdenet in ERDMIN, was merged with Nescor.

Mongolia's gold production increased sharply to more than 4 t in 1995 from about 2 t in 1994. In 1995, gold production was by several state-owned mining companies and more than 50 local and joint-venture small mining companies mainly at placer gold deposits in north-central and southwestern Mongolia. Major gold mining areas were at Tolgoyt (Tolgoit), at Ikh Ulent, Sharin Gol, Havchuu, Ikh Uvuljuu, and Burhant, all in north-central Mongolia; at Mukhar Ereg and Uvur Chuluut in the Bayakhongor area; at Hailaast, Tosongin Gol; and 13 other placer deposits along the Tuul River in Zaamar area of north-central Mongolia.

Morrison Knudsen Gold Co. (MK Gold), which terminated the Boroo gold exploration project in Tov Aymag, was inactive in 1995. However, two major joint-venture gold projects had moved forward to the development stage. In September, Shizhire Alt (Nuget), a Mongolian-Russian joint venture, opened a placer gold mine in the Zaamar area of north-central Mongolia. The mine was expected to produce about 900 kilograms of gold annually beginning in October 1995 for 30 years.[3]

In January 1995, Vancouver-based Mongolia Gold Resources Ltd. (MGR) signed a joint-venture agreement with Ulaanbaatar-based Mongol Alt (MA) for exploration and development of the Bumbat Gold Field in the Zaamar area of north-central Mongolia, about 220 kilometers northwest of Ulaanbaatar. The joint-venture project was owned 49% by

MGR and 51% by MA. MA is a semi- Government company established by the Government of Mongolia.

Under an agreement with the Government of Mongolia, MGR had been conducting exploration and feasibility study for developing the Bumbat property in Mongolia since 1993. Earlier exploration on one of the three veins indicated a proven and probable reserve of 288,000 t, averaging 15 grams per metric ton (g/t) of gold. Further exploration in 1995 on one of two nearby veins resulted in an additional proven and probable reserve of 18,700 t, averaging 27.2 g/t of gold. According to officials of MGR, the joint-venture project called for an open pit mine and milling operation, which was scheduled to start in late summer of 1996.[4]

Production of tin and tungsten remained small in 1995 because of low prices and reduced export to Russia. Tin mining was at the Bain-Mod (Modot) Mine, the Khujkhan Mine, and the Kharmaitin Mine. Tungsten mining was at the Burentsogt Mine in Dornod Aymag in southeastern Mongolia. The Ulaan Uul Mine and Khovd Gol Mine in Bayan Olgiy in western Mongolia and the Tsagaan Davaa Mine in Tov Ayamg in north-central Mongolia, near Ulaanbaatar, were not producing tungsten and remained close in 1995. The Government continued to promote further exploration and development of the Undur Tsagaan tungsten deposit in Hentiy, where ore reserves had been estimated at 141 million metric tons, grading 0.124% tungsten trioxide.

In 1995, both production and exports of fluorspar had returned to the normal level. Production of direct-shipping metallurgical-grade fluorspar was about 530,000 t, while production of acid-grade calcium fluoride (fluorspar concentrate) was 120,000 t. Metallurgical-grade fluorspar and fluorspar concentrate were all exported to Russia. Mongolsovtsvetmet, a joint-venture firm owned 51% by Mongolia and 49% by Russia, operated an underground mine and an open pit mine as well as a fluorspar concentrator at Bor Ondor in Hentiy Aymag. It also operated open pit mines at Khar-Airag, Khajuu (Khazhu) Ulaan, and Urgon (Orgon) in Dorngovi Aymag; and an underground mine at Berh in Henity Aymag.

Coal production dropped to a 9-year low in 1995 because of the continued shortage of spare parts for mining equipment. The Baga Nuur Mine and the Shariyn Gol Mine were the two major producing mines in 1995.

In June 1995, SOCO of the United States completed the testing of the Sotamo-1 wildcat well in Block XIX in the Tamtsag Basin of eastern Mongolia. According to the company, the testing results indicated the presence of hydrocarbons in the Basin. However, the well was determined to not be commercially viable and was plugged. In August, the company began drilling its second well, Sotamo 19-2 in the Tamtsag Basin. The well, which had a target depth of 3,400 meters (m), was drilled to a depth of 3,019 m, but the drilling was suspended in November for the winter. According to the company, a total of 3.4 m of what appeared to be productive oil sands were logged and an additional 43.9 m of possible oil and gas sands were identified. The results of the Sotamo 19-2 indicated that the Tamtsag Basin has the potential to become a major oil-producing provinc.[5]

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[1] Where necessary, values have been converted from Mongolian tugriks (Tug) to U.S. dollars at the rate of Tug450=US$1.00 in 1995.

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[4] The Northern Miner (Toronto). "Mongolia Gold Divides Time Between Asia and Canada." Nov. 27, 1995, p. C1.

[5] Mongolian Monthly (Seattle). "Soco Announces Oil Drill Results." V. 1, No. 11, Nov. 1995, p. 4.

Major Sources of Information

The Ministry of Energy, Geology, and Mining
Baga Toiruu 6, Ulaanbaatar 210646, Mongolia
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Major Publications

Statistical Office of Mongolia: Monthly Bulletin of Statistics, 1995.

TABLE 1
MONGOLIA: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995p/
Cement, hydraulic 3/	thousand tons	227	133	82	86	109
Coal: 3/						
Anthracite and bituminous	do.	587	570	520	500	500
Lignite and brown	do.	6,450	5,677	5,089	4,510 r/	4,371
Total	do.	7,037	6,247	5,609	5,010	4,871
Copper, mine output, Cu content 3/		90,100	105,100	96,900	99,600	100,400
Fluorspar:						
Acid grade 3/	thousand tons	120	97	77 r/	88 r/	120
Submetallurgical and other grade e/	do.	355 r/	287 r/	276 r/	85 r/	120
Total		475 r/	384 r/	353 r/	173 r/	240
Gold, mine output, Au content 4/	kilograms	800	900	1,200	2,000	4,800
Gypsum	thousand tons	25	25	25	25	25
Lime, hydrated and quicklime 3/	do.	76	68	51	66	51
Molybdenum, mine output, Mo content 3/		1,716	1,610	2,050	2,100	1,830
Salt, mine output 3/		816 r/	216 r/	14 r/	629 r/	726
Silver, mine output, Ag content 5/	kilograms	15,500	18,000	17,500	20,000	20,000
Tin, mine output, Sn content		250	190	150	100	150
Tungsten, mine output, W content		300	260	250	150	200
Uranium, mine output, U content		130	120	100	100	100

e/ Estimated. r/ Revised. p/ Preliminary.

1/ Table includes data available through July 26, 1996.

2/ In addition to the commodities listed, crude construction materials such as sand and gravel, varieties of stone such as limestone, and silica are produced, but available information is inadequate to make reliable estimate of output levels.

3/ Reported.

4/ Includes reported raw gold production and estimated gold contained in copper concentrate.

5/ Siver contained in copper concentrate.

Source: Statistical Office of Mongolia (Ulaanbaatar). Monthly Bulletin of Statistics, 1996.

THE MINERAL INDUSTRY OF

NEPAL

By John C. Wu

Nepal's mineral resources, identified by its Department of Mines and Geology (DMG), under the Ministry of Industry, included beryl, clay, coal, copper, dolomite, gemstones, gold, iron ore, lead, limestone, magnesite, mica, quartzite, salt, silica sand, dimension stone, talc, tin, and zinc. In 1995, Nepal's minerals production included clay, coal, limestone, marble, quartz, quartzite, salt, and talc. *(See table 1.)*

DMG is the Government agency responsible for implementing Nepal's mineral policy and carrying out geologic prospecting and mineral resources development. The Nepal Mines Act 1966 and the Mineral Concession Rule 1961 are the legal framework for administration of Nepal's mineral resources. The newly enacted Mines and Mineral Act 2050 simplified licensing procedures for large-scale mineral exploration and development and provided specific legal provisions on environmental management for mining and mineral resources development.

Some of the major provisions of the new mining legislation are as follows: 1) the Government can award mineral exploration and development contracts to competent parties and shareholders or joint venture with foreign parties; 2) royalties are fixed on the basis of ore grade and mineral production; 3) the Government reserves the right to explore for specific strategic minerals; 4) the Government is to enforce rules and regulations governing environmental protection, rehabilitation, and conservation of mineral resources.

Nepal's mining sector, comprised of numerous small-scale industrial minerals mining companies, has been the smallest sector of the economy. The output of the mining and quarrying industry contributed about 0.2% to Nepal's gross domestic product. Most of Nepal's mineral production was for domestic consumption. Exports of mineral commodities were estimated to have accounted for less than 10% of the country's export earnings.

Mining of various industrial minerals by privately owned small mining firms was sparsely distributed throughout the country. Limestone was mined for the production of cement and lime and for construction materials. Boulders, clay, marble, quartz, quartzite, and sand were mined for domestic consumption and for export, principally to India. Nepal produced a small amount of coal (lignite) and salt, but most of the coal and salt requirements were met by imports from India.

Mining of crude magnesite at Kharidhunga in Dolkha District, about 110 kilometers northeast of Kathmandu, the national capital, had stopped in 1990 because of technical problems at a processing plant producing salable dead-burned magnesite. According to DMG, ore reserves at the Kharidhunga deposit were estimated at 180 million metric tons (Mt), of which 66 Mt were refractory-grade magnesite. Of this 66 Mt, 25 Mt were high-grade recoverable reserves. The Kharidhunga deposit is a crystalline, breunnerite type. The magnesium oxide (MgO) content of ore varies from 88% to 96%, with a maximum 4.5% each for silica (SiO_2) and iron oxide (Fe_2O_3), and 1% each for aluminum oxide (Al_2O_3) and calcium oxide (CaO).

Nepal Orind Magnesite Ltd., the owner and operator of the crushing plant at Kharidhunga and a 50,000-metric-tons-per-year (t/yr) dead-burned magnesite processing plant in Mankha Village near Lamosangu in Shindhupalchowk District, undertook a minor modification project with Government funds and technology provided by Refractories Consulting & Engineering GmbH of Austria. Upon completion of this first-stage redevelopment project, the plant was expected to operate at 50% capacity. The company also operated an open pit talc mine and talc grinding plant at Kharidhunga. The 10,000-t/yr talc plant has been operating since April 1983. The proven talc reserves in the Kharidhunga area were estimated at 300,000 metric tons.[1]

Nepal's cement industry, consisted of three medium-size and two small-size cement companies with a combined capacity of about 570,000 t/yr. Hetauda Cement Industries Ltd., a state-owned company that has a limestone quarrying operation with 9.6 Mt of proven reserves, operated a 260,000 t/yr cement plant at Bhainse in Makwanpur District. Cement-grade limestone produced from the Okhare deposit in Makwanpur District, with 9 Mt of proven reserves, also supplied Hetauda's cement plant. Himal Cement Co. Ltd., which has a limestone quarrying operation with 15.3 Mt of proven reserves, operated a 50,000-t/yr cement plant at Chobhar in Lalitpur District. Udayapur (Udaipur) Cement Industry Ltd., which has a limestone quarrying operation with 73.5 Mt of proven reserves, operated a 240,000-t/yr cement plant at Jaljale in Udaipur District. These two small privately owned cement plants with 30-metric ton-per-day capacity operating at Jogimara and at Beldanda, both in Dhading District.

In July 1995, an agreement was signed between the

Maruti Cement Ltd. and the Somani Cement Ltd. of India for building a 108,000-t/yr cement plant at Mirchaiya in Siraha District. Construction on the cement plant was scheduled to start in late 1995 or early 1996.[2]

Major Sources of Information

Ministry of Industry
Department of Mines and Geology
Lainchaur, Kathmandu, Nepal.

TABLE 1
NEPAL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1991	1992	1993	1994 e/	1995 e/
Cement	184,000 r/	237,327 r/	273,532 r/	280,000	300,000
Clay, red	8,850	15,400	8,950	8,000	9,000
Coal:					
Bituminous	200	1,900	1,150	1,200	1,200
Lignite	10,200	14,100	3,810	4,000	4,000
Total	10,400	16,000	4,960	5,200	5,200
Copper ore:					
Gross weight	21	12	23	22	20
Cu content	4	2	2	2	2
Gemstones:e/					
Quartz kilograms	1,060	6,000	5,000	5,000	5,000
Tourmaline do.	4	--	(3/)	--	--
Total do.	1,064	6,000	5,000	5,000	5,000
Lime, agricultural	24,500	24,500 e/	24,000 e/	25,000	25,000
Salt	7,300	6,500	6,600	7,000	7,000
Stone					
Limestone	222,000	368,000	296,000	300,000	350,000
Marble:					
Chips	1,040	567	292	300	500
Slab, cut square meters	24,700	20,400	27,900	28,000	25,000
Craggy do.	6,460	6,430	2,940	3,000	3,000
Quartzite do.	2,980	2,360	2,550	2,500	2,600
Talc	3,170	3,820	1,340	1,500	1,500

e/ Estimated. r/ Revised.

1/ Table includes data available through Aug. 28, 1996.

2/ In addition to the commodities listed, construction materials such as sand and gravel and other varieties of stone presumably are produced, but available information is inadequate to make reliable estimates of output levels.

3/ Less than 1/2 unit.

Source: Ministry of Industry, Department of Mines and Geology (Kathmandu). Minerals and Mineral-Based Industries in Nepal, Dec. 1994.

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[1] Kayastha, N. B., Department of Mines and Geology (Kathmandu). Minerals and Mineral-Based Industries in Nepal, 1994, p. 2.

[2] Nepal Press Digest (Kathmandu). "A New Cement Factory." V. 39, No. 30, July 24, 1995, p. 283.

THE MINERAL INDUSTRY OF

NEW CALEDONIA

By Travis Q. Lyday

The mineral industry in the French Territory of New Caledonia and Dependencies continued to be dominated by the mining of nickeliferous laterite-saprolite ore. The ore was used for the subsequent production of ferronickel of various commercial grades and of matte containing 75% nickel at the Doniambo smelter at Nouméa, the capital. Minor amounts of cobalt were recovered as a component of nickel matte exports from refining operations at Sandouville, near Le Havre, in northern France. Minor amounts of pit and quarry construction materials also were produced.

New Caledonia was the largest producer of ferronickel in the world and the fourth largest producer of mined nickel after Canada, Indonesia, and Russia. Nickel mining and smelting were the territory's most important resource, accounting for an estimated 25% of the gross domestic product (GDP) and 80% of exports.

Remaining stocks of chromite concentrate produced at the Tiebaghi Mine continued to be exported. The Tiebaghi Mine, owned and operated by Chromical S.A. in the northern part of the island, was permanently closed in 1992.

Nickel was produced at mines owned by Société Métallurgique le Nickel (SLN), a 90%-owned subsidiary of Metropolitan France's Eramet, with Japan's Nisshin Steel Co. owning the remaining 10%, as well as from smaller, independent producers. SLN's production of nickel ore was from the two mining centers of Kouaoua and Thio on the east coast, the two mining centers of Kaala-Gomen and Népoui-Kopéto on the west coast, and at contractor-operated mines operated by Société Georges Montagnat at the Karembe and Tontouta mining centers on the west coast, all on the main island of La Grande Terre. Remaining production was from smaller, independent operators, including Berton, Groupe Pentacost, Société des Mines de la Toutouta, and Société Minière du Sud Pacifique, with open pit mines at Boakaine, Karembe, Kouaoua, Moeno, Nakety, Ouaco, and Tontouta.

Mine output from the independently operated mines was mainly for export to Australia's Yabulu nickel refinery near Townsville, Queensland; Japanese nickel smelters and refiners; and the Glenbrook ferronickel smelter near Riddle, Oregon; some also was used as feed for the Doniambo smelter. SLN's nickel ore primarily was used as feed for its Doniambo smelter at Nouméa for the production of ferronickel ingots and shot and nickel matte, with minor amounts exported to Japan. Most of the ferronickel production was shipped to consumers in Australia and Japan, and all production of nickel matte was shipped to Eramet's refinery at Sandouville-Le Havre for further processing into high-purity electrolytic nickel and nickel salts.

Inco Ltd. of Canada announced in midyear that it will conduct a detailed study to determine the economic feasibility of developing its Goro nickel project on the southeastern coast of the main island. The study was expected to be completed by yearend 1996 and will be based on pressure acid leaching combined with solvent extraction, which has been successfully researched at Inco's Toronto laboratory using nickel laterites from the Goro deposit. The study was to be sponsored by Goro Nickel SA, a company 85% owned by Inco and 15% by the French Government-controlled Bureau de Recherches Géologiques et Minières. The Goro project includes extensive deposits of nickeliferous laterites with identified reserves of 165 million metric tons (Mt) grading 1.6% nickel and 0.16% cobalt capable of supporting long-term nickel mining.

Reportedly, total proven and probable nickel reserves in New Caledonia were 1 Mt of contained nickel in ore grading greater than 2.7% nickel, with an additional 1 Mt of contained nickel in ore grading 2.5% to 2.7% nickel. These were considered sufficient for at least 40 years of mining at current rates.

In addition to abundant reserves of nickel ores, the island territory is well endowed with other mineral resources. Significant prospects have been reported for antimony, copper, gold, iron ore, lead-zinc, manganese, and phosphate rock. However, none of these has been mined commercially.

Major Source of Information

Le Service des Mines et L'Energie
Nouméa, New Caledonia

Major Publications

Service de la Statistique (Paris). Annuaire Statistique, annual.

Annales des Mines (Paris). Productions et Exportations Minières & Métallurgiques de la Nouvelle Calédonie, monthly.

TABLE 1
NEW CALEDONIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
Cement		89,739	90,417	90,000 e/	90,000 e/	100,000 e/
Chromite, gross weight		--	8,169	--	--	--
Cobalt, mine output: e/						
Co content		6,000	6,000	6,000	6,000	6,000
Recovered		800	800	800	800	800
Nickel:						
Ore:						
Gross weight	thousand tons	5,690	5,650	5,599	5,729 r/	7,068
Ni content		114,492	113,000	97,092	97,323 r/	121,457
Metallurgical products:						
Ferronickel:						
Gross weight e/		137,600	125,900	145,500	156,100	166,700
Metal content (nickel plus cobalt)		34,411	31,895	36,850	39,488	42,200
Nickel matte:						
Gross weight e/		12,200	10,100	19,800	19,400	18,500
Metal content (nickel plus cobalt)		9,041	7,475	10,883	10,641	10,143
Stone: e/						
Crude (unspecified)	cubic meters	25,000	25,000	25,000	25,000	25,000
Crushed	do.	125,000	125,000	125,000	125,000	125,000
Sand: e/						
Construction	do.	100,000	100,000	100,000	100,000	100,000
Silica (for metallurgical use)	do.	20,000	20,000	20,000	20,000	20,000

e/ Estimated. r/ Revised.

1/ Table includes data available through Apr. 2, 1996.

THE MINERAL INDUSTRY OF

NEW ZEALAND

By Travis Q. Lyday

The New Zealand mining industry is centered primarily on coal and gold, mineral commodities with long traditions in the country. The mineral industry in New Zealand began with the discovery of gold on the Coromandel Peninsula, North Island, in 1852. Coal mining also began in the 1850's. Since then, a wide range of minerals has been produced.

The existence of extensive iron sand deposits on the west coast of North Island has been known for more than a century, but not until the late 1960's was a steelmaking industry in New Zealand able to use successfully the iron sands and coal from an area near Waikato-North Head. Construction of the Glenbrook steelworks was completed in 1970.

Serious exploration for oil and gas began in the late 1950's, resulting in the discovery of several natural gas fields to date. The Kapuni Field was discovered in 1959 and began production in 1970, supplying gas to North Island Government distribution centers and industrial customers. The much larger Maui offshore gasfield, New Zealand's largest, was discovered in 1969. Its production has been used primarily for electricity generation and as a premium fuel.

New Zealand's extractive mineral industry constitutes only a small segment of the economy, contributing on the order of 1% to 2% to the country's gross domestic product (GDP). The mineral processing sector provides an estimated 4% to 5% to the GDP, based to a significant extent on imported alumina, crude oil, and fertilizer, increasing the value of the mineral industry output to about 5% to 6% of GDP.

Mining activities in New Zealand during 1995 continued to include coal extraction, both by underground and open cast methods; quarrying of raw materials for use primarily in domestic construction (clays, sand and gravel, and stone) and agricultural industries (limestone); and gold and titaniferous magnetite sand (iron sand) mining.

Gold production was from three large hardrock mining operations, the Golden Cross and Martha Hill Mines near Waihi at the base of the Coromandel Peninsula on North Island and the Macraes Flat Mine in the Eastern Otago region of South Island. A fourth mine was under consideration for development at Reefton, Westland, in South Island. Alluvial mining occurred at several sites, especially on South Island. Iron sand was mined by New Zealand Steel Ltd. (NZ Steel) at two sites on North Island, Waikato-North Head and Taharoa. Coal was produced from about 60 mines in both North Island and South Island. Mineral production also included natural gas, natural gas liquids, and petroleum condensate.

New Zealand's downstream mineral industry consisted of two steel mills; an aluminum smelter; aluminum, copper, and brass extrusion plants; and an oil refinery, all of which primarily used imported raw materials.

New Zealand's mining industry was regulated by legislation passed in 1991 by Parliament, namely the Crown Minerals Act and the Resource Management Act. The former prescribes the granting of prospecting, exploration, and mining permits for Crown, i.e., Government-owned, minerals, ensuring that the Government receives a return when the mineral resources are developed. The latter applies to all industries, focusing on the effects of any activity on the environment.

Macraes Mining Co. Ltd. (MMC) announced in midyear that it will proceed with development of its Globe-Progress gold mine at Reefton in the Westland region of the west coast of South Island. Construction of the mine was to begin early in 1996. The first gold was expected to be poured in the first quarter of 1997, with full production by July 1998. The open pit operation has a targeted production of 3,000 kilograms per year (kg/yr) of gold from the mining and treatment of 1 million metric tons per year of ore. The expected life of the mine was a minimum of 6 years. Since the ore was known to extend at depth, MMC also was considering the possibility of subsequent underground development.

Titanomagnetite-bearing iron sand continued to be mined and concentrated at two unique projects along the western coast of North Island by NZ Steel, a wholly owned subsidiary of Australia's BHP Steel Mining Ltd. Titanomagnetite concentrate was produced by dry-mining (bulldozing and bucketwheel excavation) methods at Waikato-North Head, about 50 kilometers (km) south of Auckland, and pumped as a slurry through an 18-km pipeline to NZ Steel's integrated Glenbrook Steelworks. NZ Steel used both wet- (suction dredging) and dry-mining methods to produce an iron sand concentrate at its Taharoa project, about 100 km farther south. The Taharoa concentrate, averaging about 40% titanomagnetite by weight, was exported exclusively to Japan in specially fitted slurry ore carriers loaded at a mooring buoy connected to shore by a 3-km slurry pipeline. The product was used as a steelmaking additive and as a refractory in blast furnace operations.

The Maui gas-condensate field off the coast of North Island remained the country's largest, supplying about one-third of the country's total energy needs. Gas production from the Maui operation was piped to the onshore Oaonui gas treatment plant where it was sold to the Crown under a long-term contract effective until 2009. The Government, in turn, sold the gas to the Electricity Corp. of New Zealand, which burned a substantial amount in the generation of electricity; Methanex NZ Ltd., which owned the synthetic gasoline and methanol manufacturing plants; and the Natural Gas Corp. Ltd., which operated the wholesale natural gas distribution system. These interests each received about one-third of Maui's gas production. Condensate production also was piped to the Oaonui plant, where it was stabilized before shipment to Port Taranaki for export to Australian refineries.

Major Sources of Information

Ministry of Commerce
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TABLE 1
NEW ZEALAND: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1991	1992	1993	1994 e/	1995 e/
METALS					
Aluminum metal, smelter:					
Primary	258,500	242,900	277,400	270,752 2/	273,296 2/
Secondary	4,700	6,700	6,700	6,700 2/	7,000
Total	263,200	249,600	284,100	277,452 2/	280,296
Gold, mine output, Au content kilograms	6,758	10,531	11,161	12,000	13,000
Iron and steel:					
Iron ore, gross weight e/ 3/	2,060	2,000	2,000	2,000	2,000
Iron sand (titaniferous magnetite):					
Gross weight thousand tons	2,265	2,934	2,389	1,100	2,000
Fe content e/ do.	1,300	1,300	1,300	600	900
Pig iron do.	594	625 r/	653 r/	563 2/	631 2/
Steel, crude do.	806	759	853	766 2/	800
Lead, refinery output, secondary e/	5,000	5,000	3,000	6,000 r/	6,000
Silver, mine output, Ag content kilograms	11,370	22,413	25,797	30,000	32,000
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	576	579	600 e/	700	700
Clays:					
Bentonite	--	--	1,613	1,500	1,500
Kaolin (pottery)	21,338	27,520	26,543	28,000	30,000
For brick and tile	121,030	55,871	130,004	120,000	125,000
Lime e/	90,000	100,000	100,000	100,000	100,000
Nitrogen: N content of ammonia	70,000	68,200	77,800	78,000	80,000
Perlite	1,674	2,000	814	1,500	1,500
Pumice	52,644	112,476	69,179	70,000	70,000
Salt e/	80,000	80,000	80,000	80,000	50,000
Sand and gravel:					
Silica sand (glass sand)	99,132	71,940	48,635	50,000	50,000
Other industrial sand	494,428	427,714	671,212	700,000	700,000
For roads and ballast thousand tons	10,460	12,520	13,502	14,000	15,000
For building aggregate do.	3,486	3,838	4,942	5,000	5,000

See footnotes at end of table.

TABLE 1--Continued
NEW ZEALAND: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994 e/	1995 e/
INDUSTRIAL MINERALS--Continued						
Stone:						
Dolomite		11,636	12,943	9,671	10,000	10,000
Greenstone e/	**kilograms**	1,000	1,000	1,000	1,000	1,000
Limestone and marl:						
For agriculture	**thousand tons**	946	1,310	1,689	1,500	1,500
For cement	do.	1,390	1,459	1,577	1,500	1,500
For other industrial uses	do.	364	399	379	400	400
For roads	do.	407	523	597	600	600
Serpentine	do.	13,647	23,786	22,386	23,000	25,000
Dimension		17,898	23,722	40,060	35,000	35,000
Rock for harbor work	**thousand tons**	5,238	1,514	1,680	2,000	3,000
Sulfur		451	--	6,600	6,000	6,000
MINERAL FUELS AND RELATED MATERIALS						
Carbon dioxide, liquefied e/		10,000	10,000	10,000	10,000	10,000
Coal:						
Bituminous	**thousand tons**	734	907	975	1,000	1,000
Subbituminous	do.	1,780	1,897	1,932	1,900	2,000
Lignite	do.	170	180	184	200	200
Total	do.	2,684	2,984	3,091	3,100	3,200
Coke: e/						
Coke oven		2,000	1,000	1,000	1,000	1,000
Gashouse		7,000	7,000	7,000	7,000	8,000
Total		9,000	8,000	8,000	8,000	9,000
Gas:						
Manufactured (from gasworks) e/	**thousand cubic meters**	11,350	11,350	11,350	11,350	11,500
Natural:						
Gross production	do.	6,290	6,707	6,030	6,000	6,000
Marketed production	do.	5,800	5,100	4,900	4,900	4,900
Natural gas liquids: e/						
Liquefied petroleum gas	**thousand 42-gallon barrels**	1,400	1,400	1,500	1,500	1,500
Natural gasoline	do.	400	400	500	500	500
Total	do.	1,800	1,800	2,000	2,000	2,000
Peat	**cubic meters**	94,396	58,647	101,476	110,000	110,000
Petroleum:						
Crude	**thousand 42-gallon barrels**	15,311	13,800	14,965	16,425 2/	16,000
Refinery products: e/						
Gasoline	do.	13,505 2/	12,500	14,000	14,000	14,000
Distillate fuel oil	do.	10,585 2/	10,500	10,500	11,000	11,000
Residual fuel oil	do.	2,555 2/	2,800	2,500	3,000	3,000
Other	do.	2,920 2/	3,000	3,000	3,000	3,000
Refinery fuel and losses	do.	1,825 2/	1,800	2,000	2,000	2,000
Total	do.	31,390 2/	30,600	32,000	33,000	33,000

e/ Estimated. r/ Revised.

1/ Table includes data available through Apr. 2, 1996.

2/ Reported figure.

3/ Not used for manufacture of iron; reportedly consumed for gas purification, preparation of stock licks, and manufacture of brick. Because of these uses, iron content is not reported.

THE MINERAL INDUSTRY OF

PAKISTAN

By Chin S. Kuo

Pakistan's mineral production in 1995 was essentially the output of its significant natural gas industry. The development and exploitation of exportable mineral commodities had been restricted by the lack of large mineral resources. There was no short supply of industrial minerals for domestic consumption.

The Government devalued the rupee by 7% against the U.S. dollar in an effort to bolster exports which had been stagnating. It also boosted domestic oil prices by the same margin and imposed a 10% surcharge on imports.

The Government was looking to achieve a breakthrough in investment in the mineral industry by attracting large-scale investment from the private sector, both local and overseas. The Geological Survey of Pakistan with the assistance of Asian Development Bank was formulating a 10-year mineral exploration program to cover 14 identified potential mineralized zones. One of the most significant targets was the Thar coalfield in Sind Province. An iron ore resource at Chiniot on the Punjab plains also was identified.

The fiscal scheme for investment was attractive in 1995. There are prominent tax exemptions and a reduction of development expenditures at 25% per year to enable recovery within a 4-year period. Custom duties on machinery and equipment will be only 5% until the beginning of commercial operation and 10% thereafter with no sales tax. Imported raw materials will have a 10% custom duty and 15% sales tax levied. There is also a prescribed timeframe for the granting of mineral titles. New ad valorem royalty rates were being introduced for precious stones and metals as well as semiprecious stone and base metals. After 1995, there will be no mandatory state participation and no ban on repatriation of profits. Also, tax withholding for corporate non-residents will be set at 7.5% and adjusted against the final tax liability.

The new import policy of 1995 banned the importation of gold by individuals. Only registered importers could import gold against their own foreign exchange resources. Any amount of gold could be imported subject to a 2% duty.

Under the 1994 petroleum policy, the Government has to decide, within 3 months of a commercial discovery being declared by an exploration company, the buyer to which the natural gas should be sold. The Government also removes import and other duties on machinery and materials brought in for exploration and makes credit easier. However, if companies make a commercial discovery, they must pay 3% per year on the value of machinery imported. The petroleum policy was aimed at promoting private-sector investment and increasing oil and gas output.

The Government was drafting a hydroelectric power policy that was likely to offer a 25% return to private investors in projects with a capacity of 2,000 megawatts (MW). The policy also would offer a fixed net profit to investors for every kilowatt of power produced and a royalty to Provinces where the utility was located. In addition, investors would receive exemption from custom duty and sales tax on imports of equipment and machinery for projects. The country's hydroelectric potential was 50,000 MW with 10,000 MW easily obtainable from available water resources.

Pasminco Ltd. of Australia signed a joint-venture agreement with Pakistan Mineral Development Corp. and Baluchistan Development Authority in Quetta for further exploration ($15 million) and possible development ($15 million) of the Duddar zinc deposit. Initial investigations indicated a resource of 10.3 million metric tons (Mt) grading 11.4% zinc and 2.1% lead.[2] Pasminco would have the right to earn a 75% interest in the project. The company also would carry out other regional exploration drilling over an area of 3,000 square kilometers (km^2) in the Mor Range and Piaro Ridge districts of Baluchistan.

The Baluchistan Provincial government signed an agreement for Petrie International Inc. of the United States to mine titanium in the Ziarat/Loralai area and explore for other minerals such as copper and gold in Dalbandin. Petrie would invest $3 million initially for a period of 1 year. There was at least 15 Mt[3] of titanium ore.

The Government attempted to sell the state-owned phosphate producers, Lyallpur Chemicals & Fertilizers and Hazara Phosphates. Lyallpur Chemicals produced 100,000 metric tons per year (t/yr) of single superphosphate (SSP) at Jaranwala. Hazara Phosphates operates a 90,000-t/yr SSP plant at Haripur, Abbottabad district.

FFC-Jordan Fertilizer Co., a joint venture of Fauji Fertilizer Co. (40%) and Jordan Phosphate Mines Co. (60%), secured a $30-million loan from the Canadian Export Development Corp. for its planned fertilizer complex at Port Qasim. Kreditanstalt fur Wiederaufabau of Germany granted a loan of $53 million. A consortium of French banks was to provide a loan of $57 million, and the Export-Import Bank of the United States agreed to a loan of $40 million. The total cost of the project was estimated at $300 million. The complex would produce 445,000 t/yr of diammonium phosphate (DAP), 551,000 t/yr of urea, and 460,000 t/yr of ammonia. The plants were scheduled for startup in late 1997 with the ammonia plant startup in 1996.

Al-Noor Fertilizer Industries Ltd. completed financing agreeements for its proposed DAP/urea complex at Dhabeji, 50 km from Karachi. The company obtained about $126 million in foreign currency loans for the $220 million project. The 390,000-t/yr DAP and 396,000-t/yr urea plants were scheduled to come on-stream at yearend 1997. A phosphoric acid-receiving terminal was to be built at Port Qasim, and ammonia would be supplied from a 320,000-t/yr unit.

More than half (60%) of the Baluchistan Province's 200 coal mines were shut down for more than 3 months, and the rest were operated on a limited basis because of competition and taxes. At stake were the jobs of 30,000 miners and 60,000 people in coal-related services as well as the Baluchistan coal mining industry. Baluchistan produced an average of 2 million metric tons per year (Mt/yr) of coal in the past few years, and its output was on the decline. The Provincial government of Baluchistan was trying to persuade local and foreign investors to set up power projects near coalfields to provide new markets. However, coal production from the southern Province of Sind had increased to 2.5 Mt/yr. The Thar coalfields were estimated to have reserves more than 175,000 Mt.[4]

The Thar Coal Board approved three integrated projects for coal mining and power generation in Sind Province. The three projects would require an estimated total investment of $1.7 to $2.1 billion and have a total capacity of 1,620 MW. The project planned by Hongpak United Power Generation joint venture would build two 660-MW coal-fired plants in Thar. BBI Power would construct a 200-MW plant based on the Lakhra Coalfield. Sind Coal Electric Power would build a 100-MW plant on the Jherruk-Sonda Coalfield in Thatta district.

A coal mine explosion in Baluchistan killed at least 27 miners in February 1995. The methane gas explosion and resultant fire occurred at a depth of between 700 and 900 meters at Gilani Coal Co.'s mine at Sinjadi, 80 km east of Quetta. A portion of the mine collapsed and hampered the rescue efforts.

Pakistan produced 60,000 barrels per day (bbl/d) of oil and 52.4 million cubic meters per day (m^3/d) of gas. The target for 1998 was 123,000 bbl/d of oil. Output of liquefied petroleum gas would be 400 metric tons per day in the next 2 years. The Mari Gasfield supplied the natural gas to three major fertilizer plants and a powerplant. Lasmo Oil Pakistan's Kadanwari Oilfield in Sind Province was brought into production in May. Output would rise gradually to 2.83 million m^3/d, and gas from the field would be sold to Sui Southern Gas Co. The country's demand for gas was expected to rise from the current 62.3 million to 169.8 million m^3/d by the year 2000.

Pakistan and Turkmenistan planned to build a $3-billion natural gas pipeline across Afghanistan linking Turkmenistan's Svetabad gasfields and the southwestern city of Quetta. The pipeline would supply up to 56.6 million m^3/d of gas. The project was to be financed entirely by the private sector.

Pakistan and Iran planned to invite bids for an overland gas pipeline from Iran's southern oilfields to Sind Province in Pakistan. The 45.3 million m^3/d pipeline, costing between $3.5 and $4 billion, was expected to be operational by the year 2001. The country's other pipeline project, the 45.3-million-m^3/d offshore line from Qatar, would cost $3.5 billion. The pipeline would link Ras Raffan in Qatar with Gadani in Pakistan. Construction of the 1,600-km pipeline was to start in early 1996 with completion scheduled for 1999. Brown & Root of the United States, Crescent Petroleum, Itochu of Japan, and TransCanada Pipelines are the partners in the project.

Unocal Corp. of the United States signed three agreements for exploration of oil in different areas of the country. Unocal would carry out seismic and gravity surveys and drill an exploratory well within 3 years with a minimum financial commitment of $6 million. Union Texas Pakistan Inc. received an exploration license for a block in southern Sind Province covering 688,000 hectares for an initial 2 years. The company had discovered oil in the Badin block of southeastern Pakistan and had produced 19,500 bbl/d of oil and 4.58 million m^3/d of natural gas. The partners in the block are Union Texas (30%), Occidental Petroleum (30%), both of the United States, and Oil and Gas Development Corp. (40%). The country produced 60,000 bbl/d of oil, one-fourth of its needs, and the rest was imported.

In 1995, Pakistan State Oil expected to signed an agreement with Hyundai Engineering and Construction of the Republic of Korea to build an $800-million, 90,000-bbl/d refinery at Badin, Sind Province. Construction would begin within 30 months of the signing of the agreement. Also in 1995, Pakistan and Iran completed an agreement to build jointly an oil refinery in Karachi at a cost of $1 billion. The refinery would have a capacity of 120,000 bbl/d.

The country has about 10,800 MW of installed electric capacity, but demand for power has grown at 10% to 12% per year for the last 20 years. Pakistan Suzuki Cement and China International Water and Electric signed an initial contract for two 25-MW powerplants to be built at Haripur, near Islamabad. The Chinese would provide all equipment and technology for the turnkey project. Smith Cogeneration Development Ltd. of the United States signed an agreement to build a 200-MW coal-fired utility near the Lakhra Mine in Sind Province which produced high-sulfur lignite. The mining and power generation of the $250-million project would be totally funded from overseas. The mine was to operate at 1 Mt/yr with equipment imported from China. Completion was expected by the end of 1996.

AES Lal Pir Ltd. of Pakistan was to build two 362-MW oil-fired plants in the district of Muzaffargarh, Punjab Province, with investment of $700 million. Loans arranged by Bank of Tokyo, Sanwa Bank, and Deutsche Bank would provide $240 million of the financing for the first plant's $375 million cost. International Finance Corp. signed an agreement to provide up to $49.5 million in loans and investments. AES Corp. of the United States would fund the rest. The project would have a single fuel-oil boiler and a single steam-turbine generator. Mitsubishi Heavy Industries of Japan would deliver the plant on a turnkey basis, and commercial operations were expected to start in December 1997. The Water and Power Development Authority was to buy the project's energy under a 30-year power purchase agreement.

In 1995, a joint venture involving Habibullah Energy Ltd., ABB Energy ventures, and Ogden Projects Inc., all of the United States, to build a $110-million, 140-MW combined cycle plant was formed. However, the lack of a firm gas supply commitment from the Government could delay the project. In another development, Consolidated Electric Power Asia of Hong Kong was expected to build a $5.5-billion, 5,280-MW coal-fired plant and associated transmission lines and infrastructure on the southern Sind coast. There would be eight 660-MW units with the first to come into operation by December 1997 and the last by mid-2000. The plant would need between 30 and 35 Mt/yr of coal, which was expected to come first from imports and later from the Thar coalfields in Sind Province. The Provincial government objected to the period of 8 to 10 years proposed for the switch from imported to local coal.

Construction of a 300-MW nuclear powerplant by Chinese at Chashma in northern Punjab Province was proceeding according to schedule and would be completed in 1998. The country was in the final stage of negotiations to buy another 300-MW plant from China to be built also at Chashma. The objective was to generate 4,600 MW from nuclear plants by the year 2006.

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[1] Where necessary, values have been converted from Pakistani rupees (R) to U.S. dollars at the rate of R31.50=US$1.00 for 1995.

[2] American Metal Market. May 31, 1995, p. 2.

[3] Mining Journal. June 30, 1995, p. 481.

[4] Journal of Commerce. Feb. 27, 1995, p. 4B.

Major Sources of Information

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Geological Survey of Pakistan
  Quetta, Pakistan
Oil and Gas Development Corp.
  Islamabad, Pakistan
Pakistan Mineral Development Corp.
  Karachi, Pakistan
Pakistan Petroleum Limited
  Islamabad, Pakistan
Water and Power Development Authority
  Lahore, Pakistan

Major Publications

Federal Bureau of Statistics, Karachi:
  Foreign Trade, monthly.
  Pakistan Statistical Yearbook, annual.
  Statistical Bulletin, monthly.

TABLE 1
PAKISTAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
METALS						
Aluminum, bauxite, gross weight		4,324	3,461	4,845	4,570 r/	8,000
Antimony ore:						
Gross weight		75	83	--	--	40
Sb content e/		11	12	--	--	6 2/
Chromium, chromite:						
Gross weight		31,474	22,852	22,154	6,240 r/	17,000
Cr content e/		10,380	7,500	7,400	2,810 r/	7,650
Iron and steel: e/						
Pig iron	thousand tons	1,100	1,100	1,200	1,045 r/ 2/	1,100
Steel, crude	do.	1,000	1,000	1,100	344 r/ 2/	409 2/
Lead, refined, secondary e/		2,500	3,000	3,000	3,000	2,500
INDUSTRIAL MINERALS						
Abrasives, natural, emery		10,819	298	666	178 r/	132 2/
Barite		28,751	32,432	26,336	20,320 r/	15,360
Cement, hydraulic	thousand tons	7,762	7,793	8,321	8,100 r/	8,586 2/
Chalk		5,428	4,280	4,770	5,597 r/	7,170
Clays:						
Bentonite		5,106	6,057	7,991	11,180 r/	5,759 2/
Fire clay		136,184	123,034	132,278	133,643 r/	139,548 2/
Fuller's earth		22,075	22,042	20,941	15,335 r/	12,862 2/
Kaolin (china clay)		44,738	37,444	37,179	47,894 r/	30,746 2/
Other		1,855,013	1,268,968	1,728,380	647,324 r/	198,199 2/
Feldspar		10,210	19,166	17,034	15,335 r/	21,163 2/
Fluorspar e/		5,300	5,000	5,100	13,351 r/	2,753 2/
Gypsum, crude		521,891	462,002	534,565	607,279 r/	313,868 2/
Magnesite, crude		5,191	6,484	4,157	4,464 r/	16,891 2/
Nitrogen, N content of ammonia		1,153,600	1,144,200	1,445,700	1,450,000 e/	1,450,000
Phosphate rock:						
Gross weight		18,985	19,828	13,822	15,042	10,460
P2O5 content e/		5,930 2/	6,000	4,300	2,560 r/	1,780
Pigments, mineral, natural, ocher		1,889	5,126	6,196	6,000 e/	6,000
Salt:						
Rock	thousand tons	769	853	895	847 r/	935 2/
Marine	do.	12	10	14	13	17 2/
Total	do.	781	863	909	860 r/	952 2/
Sand:						
Bajri and common		220,000 e/	237,676	377,859	490,623 r/	175,572 2/
Glass		151,070	135,101	167,644	170,000 e/	170,000
Sodium compounds, n.e.s.:						
Caustic soda		78,500	60,000	81,381	93,600 r/	100,000
Soda ash, manufactured		147,000	146,000	186,216	184,636 r/	200,000
Stone:						
Aragonite and marble		331,820	330,570	384,553	389,741	471,761 2/
Dolomite		213,117	153,324	192,575	225,697 r/	198,051 2/
Limestone	thousand tons	8,432	8,759	9,074	9,096 r/	9,769 2/
Other (reported as "ordinary stone")	do.	46	50 e/	50 e/	4 r/	6 2/
Strontium minerals, celestite		1,472	1,448	1,684	2,320 r/	1,625 2/
Sulfur:						
Native		255	140	410	545 r/	195 2/
Byproduct, all sources e/		26,000	26,000	27,000	27,000	27,000
Total e/		26,255	26,140	27,410	27,545 r/	27,195
Talc and related materials, soapstone		33,643	23,676	46,846	37,151 r/	35,043 2/
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades	thousand tons	3,040	2,751	3,305	3,082 r/	2,997 2/
Coke e/	do.	650	650	670	701 r/ 2/	720
Gas, natural:						
Gross production	million cubic feet	518,483	550,715	583,545	590,000	595,000
Marketed production (sales) e/	do.	450,000	450,000	500,000	500,000	500,000
Natural gas liquids e/	thousand 42-gallon barrels	80	85	85	85	80
Petroleum:						
Crude	do.	23,027	22,686	21,467	22,000	23,000

See footnotes at end of table.

TABLE 1--Continued
PAKISTAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum--Continued:						
Refinery products: e/						
Gasoline	thousand 42-gallon barrels	7,200	7,300	7,300	7,400	7,500
Jet fuel	do.	4,200	4,200	4,500	4,500	4,500
Kerosene	do.	3,200	3,200	3,300	3,300	3,300
Distillate fuel oil	do.	13,500	13,600	13,600	13,800	14,000
Residual fuel oil	do.	12,200	12,300	12,300	12,400	12,500
Lubricants	do.	1,200	1,200	1,300	1,300	1,300
Other	do.	4,100	4,200	4,200	4,300	4,300
Total	do.	45,600	46,000	46,500	47,000	47,400

e/ Estimated. r/ Revised.

1/ Table includes data available through Aug. 19, 1996.

2/ Reported figure.

THE MINERAL INDUSTRY OF

PAPUA NEW GUINEA

By Travis Q. Lyday

The mineral industry was the cornerstone of the country's economy in 1995, as it has been since 1972 when the world-class Panguna porphyry copper-gold deposit on Bougainville Island in North Solomons Province concluded its first full year of production. Mining consisted of large, modern, mechanized operations, such as the Ok Tedi copper mine in Western Province and the Misima opencast and Porgera underground-open pit gold operations in Milne Bay and Enga Provinces, respectively, as well as panning and crude sluicing activity by individuals and small gold mining companies. Papua New Guinea's petroleum industry began in 1991 with commencement of production from the Iagifu-Hedinia Oilfield, discovered in 1987.

The Government approved in March the long-awaited Special Mining Lease (SML) for the gold project on Lihir Island, New Ireland Province, as well as a reduction in the tax rate on mining leases held by small and medium sized mining companies. Clayfield Pty. Ltd.'s newly commissioned Tolukuma Mine, Central Province, was the first to benefit from the lower tax. The Government announced its intention to sell a major portion of the equity in its US$1.25 billion State-owned Mineral Resources Development Co. (MRDC), which was to become the sole vehicle for holding State equity in any future projects.

At yearend, there were four metal mines (Misima, Ok Tedi, Porgera, and Tolukuma), one gas project (Hides), and two petroleum fields (Agogo and Iagifu-Hedinia). These produced virtually all of the country's mineral production, excluding minor amounts of alluvial gold by individual panners and clays, sand and gravel, and stone for construction purposes. A fifth mine, the Panguna, remained closed throughout the year owing to civil unrest by Bougainville Revolutionary Army militants.

Minerals and petroleum exports represented about 68% of the country's total exports and an estimated 23% of the gross domestic product in 1995. Papua New Guinea remained the sixth largest exporter of gold in the world in 1995, primarily shipping to the Perth, Western Australia, refinery and mint.

Gold from the Porgera Mine continued to account for about 40% of all export revenues and 10% of the Government's income. Virtually all nonfuel mineral production was exported in the form of doré, bullion, and copper-gold-silver concentrates. All petroleum production also was exported.

The country's only cement company, PNG-Halla Cement Pty. Ltd. in Lae, Morobe Province, secured its first contract for supplying cement overseas. Under an agreement with the Melanesian Spearhead Group, PNG-Halla will supply 600 metric tons per month of cement to Vanuatu, renewable after the first year. Reportedly, similar agreements were being negotiated with Australia, Indonesia, and other Pacific Islands.

Since the closure of Bougainville Copper Ltd.'s Panguna Mine on Bougainville Island in North Solomons Province in 1989, all of the country's copper production continued to be from the Ok Tedi Mine on Mount Fubilan in the Star Mountains of Western Province, 18 kilometers (km) east of the border with the Indonesian Province of Irian Jaya.

Australia's Victoria State Supreme Court ruled near yearend that it had the jurisdiction to hear the case against BHP Minerals Holdings Pty. Ltd., the managing shareholder of the Ok Tedi Mine that has its headquarters in Melbourne, Victoria. The lawsuit was filed in May 1994 on behalf of a group of Papua New Guinean landowners by the Australian specialist law firm Slater and Gordon of Melbourne, Victoria. The lawsuit has sought compensation for alleged environmental damage resulting from the dumping of 80,000 metric tons per day of tailings from the Ok Tedi Mine into the Fly River system via the Ok Tedi River. The Ok Tedi River drains southward, joining the Fly about 200 km downstream; the Fly flows for another 300 km, emptying into the Gulf of Papua New Guinea.

The Ok Tedi Mine was the world's eighth largest individual copper mine in 1995. Excluding expenditure on infrastructure development, purchasing programs, and aid development for communities in the mining lease area and along the Ok Tedi-Fly River systems, Ok Tedi Mining Ltd., operator of the joint venture, has paid about US$408 million to the National and Provincial governments in taxes, duties, fees, royalties, and dividends.

The Government granted in March the SML for the Lihir gold project on Lihir Island, 600 km northeast of the Papua New Guinea mainland in New Ireland Province, enabling the joint-venture partners to begin mine development at the remote site for a projected startup of mining by 1998. Development of the project originally was due to commence in 1993, but lengthy negotiations between the partners, the Government, and local landowners delayed final approval and granting of the SML until an agreement was reached between the parties early in the year.

At settlement, ownership consisted of Southern Gold (Bahamas) Ltd., a subsidiary of RTZ Corp. Plc., 40%; Niugini Mining Ltd., 30%; and the State of Papua New Guinea through its MRDC, 30%. (Under the agreement, the landowners were to receive one-half of the Government's share, to be paid for from dividends the mine expected to be paying in 1998). The three partners assigned their respective holdings to a new company, Lihir Gold Corp., to develop and manage the project, and Lihir Gold was floated for public offering in midyear on the Australian Stock Exchange.

The Lihir gold project was being designed for a mine life of 37 years, with open pit operations scheduled for the first 15 years. Ore production from the open pit was to be split into higher-grade direct process ore, and sent to the process plant as mined; the lower-grade stockpile ore would be treated at the end of the 15 years. Annual production during the first 15 years was to average about 19,000 kilograms (kg) of gold, decreasing to an annual rate of about 7,000 kg of gold for the remaining 22 years of operation when the stockpile material was to be processed.

Placer Niugini Pty. Ltd.'s Misima Mine on Misima Island, Milne Bay Province, poured its 2-millionth troy ounce (tr oz), or 62.2 metric tons (t), of gold early in August, after 6 years of production. Originally, the mine was estimated to contain 2.2 million tr oz, or 68.4 t, of recoverable gold; Placer Niugini has reestimated that the mine has about 6 years of operation remaining.

Clayfield Pty. Ltd., a wholly owned subsidiary of Dome Resources NL of Sydney, Australia, poured early in December the first gold at its Tolukuma gold mine, about 100 km north of Port Moresby in the Fane area of Central Province. The mine was scheduled to produce about 1,500 kilograms per year (kg/yr) of gold and 4,300 kg/yr of silver over a 5-year mine life. The project is accessible only by air.

Australia's Union Mining NL, operator-manager with a 51% interest, and Macmin NL, 49%, poured in late December the first gold at their Wapolu gold mine on Fergusson Island, 350 km east of Port Moresby in Milne Bay Province. Initial production was expected to be approximately 1,000 kg/yr from the Dagwalala and Didigayagaya pits during the mine's minimum projected 4-year life.

Exploration work was expected to resume early in 1996 at the Mount Kare hardrock gold project, 18 km southwest of the Porgera Mine in Enga Province, following Papua New Guinea's National Court decision that has apparently resolved a 2-year dispute over ownership. The National Court confirmed late in the year that Matu Mining Pty. Ltd., a wholly owned subsidiary of Carpenter Pacific Resources Ltd., held the hardrock mining rights in the Mount Kare exploration license area. The decision followed a Papua New Guinea Supreme Court ruling in July that overturned a 1993 National Court decision awarding landowner Kare-Puga Development Corp. (KDC) the hardrock rights for the area over which it held the alluvial-colluvial rights. Matu Mining has agreed to give a 10% share of the hardrock mining rights in the exploration license area to KDC; KDC continues to hold 100% of the alluvial-colluvial mining rights.

PNG Oil Refinery Pty. Ltd., developer of the planned Kopi oil refinery on Motukea Island in Fairfax Harbour, Gulf Province, signed in October agreements with the chief contractor, CBI Constructors, and chief engineer, Howe-Baker Engineers Inc., for process, design, and fabrication of the facility. The refinery was to be able to process 30,000 barrels per day of crude using conventional processing technology. Oil from the Kutubu Project was to be used as the main component, although other light crudes also would be able to be refined. The refinery, in addition to direct import substitution, would establish a valued-added industry of 12.5% and provide employment for 250, mainly local, people.

All of the country's petroleum production was exported from the marine export terminal in the Gulf of Papua and sold to refineries in Australia, Japan, and Southeast Asia. Natural gas production from the Hides Gasfield production was flared, except for the small amount used at the Porgera Mine. The country's only refinery, the small topping Iagifu Ridge Refinery 200 meters above Lake Kutubu in Southern Highlands Province, produced a small quantity of aviation and diesel fuels from condensate both for sale within the country and in conjunction with the Kutubu Project itself.

Major Sources of Information

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TABLE 1
PAPUA NEW GUINEA: PRODUCTION OF MINERAL COMMODITIES 1/

Commodity 2/		1991	1992	1993	1994	1995
Copper, mine output, Cu content	metric tons	204,459	193,359	203,945	206,239	212,737
Gold, mine output, Au content	kilograms	60,780	71,190	60,587	60,287 r/	52,635
Petroleum, crude	thousand 42-gallon barrels	68 r/	19,313 r/	45,884 r/	44,008 r/	36,344
Silver, mine output, Ag content	kilograms	124,880	95,498	96,094	77,758 r/	65,226

r/ Revised.

1/ Table includes data available through Apr. 2, 1996.

2/ In addition to the commodities listed, cement and crude construction materials (common clays, sand and gravel, and stone) are produced, but output is not reported quantitatively, and available general information is inadequate to make reliable estimates.

TABLE 2
PAPUA NEW GUINEA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Cement	thousand tons	PNG-Halla Cement Pty. Ltd. [Halla Cement Corp. of South Korea, 50%, and State of Papua New Guinea, 50%]	Lae, Morobe Province	500
Copper	do.	Ok Tedi Mining Ltd., operator. [BHP Minerals Holdings Pty. Ltd., managing shareholder, 52%; Mineral Resources Development Co. (State of Papua New Guinea), 30%; and Inmet Mining Corp. of Canada, 18%]	Ok Tedi Mine, Mount Fubilan, Western Province	145
Do.	do.	Bougainville Copper Ltd., operator and manager. [CRA Ltd., 53.6%; public shareholders, 27.3%; and Mineral Resources Development Co. (State of Papua New Guinea), 19.1%]	Panguna Mine, Bougainville Island, North Solomons Province 1/	180
Gold		Lihir Gold Corp., developer and manager. [Southern Gold (Bahamas) Ltd., a 75:25 joint venture between RTZ Corp. Plc. and Vengold Inc., 22.8%; Mineral Resources Lihir Pty. Ltd. (State of Papua New Guinea), 17.15%; Niugini Mining Ltd., 17.15%; and public shares, 42.9%]	Lihir project, Lihir Island, New Ireland Province 2/	18
Do.		Misima Mines Pty. Ltd., operator and manager. [Placer Niugini Pty. Ltd., 80%; and Mineral Resources Development Co. (State of Papua New Guinea), 20%]	Misima Mine, Misima Island, Milne Bay Province	6
Do.		Kare-Puga Development Corp. (local landowner group), 100% for alluvial-colluvial rights. Matu Mining Pty. Ltd., subsidiary of Pacific Resources Ltd. of Australia, 90%, and Kare-Puga Development Corp., 10%, for hardrock rights.	Mount Kare deposit, 18 km southwest of the Porgera Mine, Southern Highlands Province 3/	5
Do.		Ok Tedi Mining Ltd., operator. [BHP Minerals Holdings Pty. Ltd., managing shareholder, 52%; Mineral Resources Development Co. (State of Papua New Guinea), 30%; and Inmet Mining Corp. of Canada, 18%]	Ok Tedi Mine, Mount Fubilan, Western Province	15
Do.		Bougainville Copper Ltd., operator and manager. [CRA Ltd., 53.6%; public shareholders, 27.3%; and Mineral Resources Development Co. (State of Papua New Guinea), 19.1%]	Panguna Mine, Bougainville Island, North Solomons Province 1/	10
Do.		Placer (PNG) Pty. Ltd., manager, 25%; Highlands Gold Properties Pty. Ltd., 25%; RGC (Papua New Guinea) Pty. Ltd., 25%; and Mineral Resources Porgera Pty. Ltd. (State of Papua New Guinea), 25%	Porgera Mine, 130 km west of Mount Hagen, Enga Province	30
Do.		Clayfield Pty. Ltd., wholly owned subsidiary of Dome Resources NL, 100%	Tolukuma Mine, 100 km north of Port Moresby, Central Province	2
Silver		Misima Mines Pty. Ltd., operator and manager. [Placer Niugini Pty. Ltd., 80%; and Mineral Resources Development Co. (State of Papua New Guinea), 20%]	Misima Mine, Misima Island, Milne Bay Province	100
Do.		Ok Tedi Mining Ltd., operator. [BHP Minerals Holdings Pty. Ltd., managing shareholder, 52%; Mineral Resources Development Co. (State of Papua New Guinea), 30%; and Inmet Mining Corp. of Canada, 18%]	Ok Tedi Mine, Mount Fubilan, Western Province	30
Do.		Placer (PNG) Pty. Ltd., manager, 25%; Highlands Gold Properties Pty. Ltd., 25%; RGC (Papua New Guinea) Pty. Ltd., 25%; and Mineral Resources Development Co. (State of Papua New Guinea), 25%	Porgera Mine, 130 km west of Mount Hagen, Enga Province	5
Do.		Clayfield Pty. Ltd., wholly owned subsidiary of Dome Resources NL, 100%	Tolukuma Mine, 100 km north of Port Moresby, Central Province	4

See footnotes at end of table.

TABLE 2--Continued
PAPUA NEW GUINEA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Natural gas thousand cubic meters per day	BP Petroleum Development Ltd., operator and manager, 92.5%, and Oil Search Ltd., 7.5%	Hides Gasfield, Southern Highlands Province	425
Petroleum thousand 42-gallon barrels per day	Chevron Niugini Pty. Ltd., operator and manager, 19.375%; BP Petroleum Development, 19.375%; Ampol Exploration Ltd., 16.46%; BHP Petroleum (PNG) Inc., 9.69%; Oil Search Ltd., 7.76%; Merlin Pacific Petroleum Co., 4.84%; and Petroleum Resources Kutubu Pty. Ltd. (State of Papua New Guinea), 22.5%	Kutubu Project (Agogo and Iagifu-Hedinia Oilfields), Gulf and Southern Highlands Provinces	140
Do. do.	Barracuda Pty. Ltd., operator and manager, 20%; Southern Highlands Petroleum, 50%; Oil Search Ltd., 20%; Nomenco PNG Oil Co., 7%; and Mountains West Exploration Inc., 3%	South East Gobe Oilfield, Gulf Province	40

e/ Estimated.

1/ Closed since May 1989 because of civil unrest.

2/ Under development for probable 1998 commissioning.

3/ Production was limited to alluvial-colluvial operations.

THE MINERAL INDUSTRY OF

PHILIPPINES

By Travis Q. Lyday

Agriculture was most important to the Philippine's economy; rice, fruit, and coconut were the major cash crops. The mining and quarrying sector of the minerals industry continued to decline in importance, contributing less than 1.5% to the country's gross domestic product in 1995. Although copper and gold remained the backbone of the country's mineral sector, production has been hampered for several years by the effects of natural disasters—including intense volcanic activity, cyclonic storms resulting in severe flooding, and periods of extensive drought—along with low international prices, and an inadequate mining law. Additionally, foreign investment was impeded by the requirement for 60% domestic equity control and high excise taxes (mineral royalties) on production.

The President of the Philippines on March 3, 1995, signed into law Republic Act 7942, an *Act Instituting a New System of Mineral Resources, Exploration, and Conservation.* This long-awaited landmark piece of legislation, more commonly referred to as the Philippine Mining Act of 1995, had been sought by the Philippine mining industry through the Philippine Chamber of Mines for nearly a decade—since ratification of the Philippine Constitution in 1987. Along with the Excise Tax Act of 1994 that reduced excise tax (royalty) rates on metallic and industrial minerals and quarry resources, these measures were expected to enable the domestic mining industry to regain its competitiveness. Small-scale mining was not affected by the new mining act; this sector still was to be governed by Republic Act 7076, the Small-Scale Mining Act.

The new mining code allowed companies (contractors) to obtain an exploration permit granting them the right to explore for all minerals within a specified area for up to 4 years (initially 2 years, but renewable for another 2 years). Upon finding a viable deposit, the code provided four basic types of production agreements, with a duration of up to 50 years (initially 25 years, renewable for another 25 years):

1. Mineral production sharing agreement. The contractor would provide all of the necessary financing, technology, personnel, and management; and the Government would receive a share of the gross output as excise tax revenue.

2. Coproduction agreement. The Government would enter into a negotiated agreement with the contractor, providing input into the operation apart from the mineral resource itself (the Government already has ownership of the minerals) in exchange for a share percentage of the gross production; the Government also would receive excise taxes, the contractor's income tax, withholding tax, and any other taxes and fees required by law.

3. Joint-venture agreement. Both the Government and the contractor would hold equity shares in the project, with the Government entitled to its share of the gross production, as agreed, in addition to all taxes and fees relative to the mining output.

4. Financial or technical assistance agreement (FTAA). The FTAA was designed to encourage large-scale projects requiring an investment of at least US$25 million. Unlike the other types of agreement that only allow for a 40% equity interest, the FTAA would allow an initial 100% foreign ownership; however, this would have to be divested to 40% 10 years after preoperating expenses had been recovered.

The new mining code also provided for several incentives to encourage mining, including a 4-year income tax holiday; tax- and duty-free capital equipment imports; value-added tax exemptions; income tax deductions where operations are posting losses; and accelerated depreciation. In addition, the Government also has guaranteed the right of repatriation of the entire proceeds of the investment as well as freedom from expropriation.

The Department of Environment and Natural Resources was the primary Government agency responsible for conservation, management, development, and proper use of the country's natural resources, including its minerals.

The minerals industry of the Philippines employed an estimated 400,000 people, or about 1.5% of the labor force, including an estimated 300,000 workers engaged in small-scale mining and panning activities, chiefly in artisanal gold workings. The metallic sector accounted for an estimated 75% of the industry's production value and nearly 100% of export earnings. Of the dozen or so major mining companies engaged in metal mining, six produced copper, gold, and silver from various operations; one of the six companies also produced refractory chrome ore; three additional companies operated mines for gold and silver; and three companies mined nickel ore. The industrial minerals sector was dominated by the production of limestone for cement manufacture, marble, and sand and gravel for construction uses.

Refined gold and copper continued to be the country's most important mineral products, each representing more than 30% of total mineral value.

Japan remained the primary market for the country's mineral products in 1995. Almost all of the Philippine production of chromite and nickel and more than 60% of its copper concentrates were exported to Japan. The remaining copper concentrates were smelted by the Philippine Associated Smelting and Refining Corp. (PASAR) into copper cathodes at Isabel, Leyte Province, for export, again primarily to Japan.

The Philippines has had one of the oldest and most active mining industries of Southeast Asia, with a strong, established mining structure. The mining industry of the Philippines was dominated by a few large-scale private local companies mining chromite, copper, gold, nickel, and silver. Coal was mined by numerous private companies and three subsidiaries of the state-owned Philippine National Oil Co. (PNOC). One of the large Government-owned companies, the Semirara Coal Corp., produced about 65% of the country's coal. Copper, ferroalloys, and phosphate fertilizer were produced by three joint-venture firms. Cement was produced by private companies; most were Filipino owned, with only minor foreign interests.

Chromite ore production was centered in the Province of Zambales in northern Luzon where Benguet Corp. mined the world's largest single refractory chromite deposit, the Coto Mine, at its Masinloc operations.

Ferrochrome Philippines Inc. restarted production of ferrochromium in March at the rate of 3,500 metric tons per month following the return of sufficient rainfall to produce enough power to operate the plant. Ferrochrome Philippines was planning furnace and kiln renovations and repairs in 1996. Although Integrated Chrome Corp. and Philippine Minerals and Alloy Corp., formerly Ferro-Chemicals Inc., also resumed operations with the return of an adequate power supply, production was restricted during the year because of limited ore supplies.

The Canadian companies Echo Bay Mines Ltd. and TVI Pacific Inc. entered into an option in midyear to acquire Benguet's Kingking copper-gold prospect on Mindanao Island. Echo Bay and TVI were to form a new company, Kingking Mines Inc.; Echo Bay, as operator, was to acquire a 75% interest in the $18.5 million project, with TVI holding the remaining 25%. Benguet, however, retained the option to buy a 20% interest in Kingking Mines should development of the project proceed.

In December, Atlas Consolidated Mining and Development Corp. entered into a 50-year lease agreement with Astron Resources Ltd., a Malaysian-based Australian company, for the reopening of Atlas' Carmen open pit-underground and Lutopan underground copper-gold mines in the Toledo District of central Cebu Island. The companies were to share equally the net proceeds from the operation. With Astron as manager of the newly formed Toledo Copper Corp., production was expected to be 32,000 metric tons per day (t/d) within 9 months after startup and 42,000 t/d after 2 years, when the Lutopan Mine was expected to be reopened.

Lepanto Consolidated Mining Co. Inc. embarked late in the year on a program to develop additional copper-gold mineralization south of its Mankayan Mine in Benguet Province, Luzon Island. Production from this area was expected gradually to replace the remnant ores currently being mined.

Maricalum Mining Corp. was planning to rehabilitate its Sipalay copper mine on Negros Island in the central Philippines. The revitalization was expected to be completed during 1997. Maricalum had a marketing contract with Marubeni Corp. covering 90% of its copper concentrate production; the remaining 10% was sold to the country's only copper smelter at Isabel, Leyte Island, operated by PASAR.

Manila Mining Corp. increased its milling capacity to at least 8,000 t/d of ore at its placer gold mine on Mindanao with the installation of another semiautogenous grinding mill. The increase in milling capacity was to offset decreasing gold grades.

The tonnage milled at Benguet's Antamok gold operation in Benguet Province, Luzon Island, increased about 14% because of the rehabilitation project that was implemented during the year. However, the gold grade was 15% lower, and gold production for the year was 4% less than that of 1994.

The Philippines does not have a fully integrated steel sector, although several rod and bar mills and galvanizing plants have been established, all since the end of World War II.

Steelmaking in the Philippines involved scrap-based electric furnace steel melting operations, of which there were 17 facilities in 1995--13 in the National Capital Region; 3 in Pampanga Province to the northwest of Manila, the capital; and the Government-owned National Steel Corp.'s (NSC) steelworks at Iligan, Mindanao. NSC was the single largest steel company in the country, producing about one-third of total production.

The Philippine Sinter Corp., owned by Kawasaki Steel Corp. of Japan, imported iron ore fines from various overseas sources, primarily Australia, and exported iron ore sinter and pellets to Japan. The plant was opened in 1977 and has a capacity of 5 million metric tons per year (t/yr).

Manganese output was centered on the islands of Bohol, Busuanga, Marinduque, Masbate, and Siquijor, as well as in the Provinces of Zamboanga del Sur and Agusan del Norte on Mindanao. Many of the deposits, however, were small and unsuitable for large-scale mining operations.

The mainstay of Philippine nickel production continued to be Rio Tuba Nickel Mining Corp.'s Rio Tuba Mine in the far south of Palawan Island, Palawan Province. Hinatuan Mining Corp. and Taganito Mining Corp. both operated smaller mines in Surigao del Norte Province on Mindanao. All three worked lateritic nickel deposits, exporting all ore production to Japan.

Pacific Nickel Holdings, a consortium consisting of two London-based investors, Wheelock NatWest (a Hong Kong affiliate of the United Kingdom's National Westminster Bank) and Australia's Minproc Engineering, reportedly reached agreement near yearend with the Government's Asset Privatization Trust (APT) for the purchase of the nickel mines and refinery, previously operated by Philnico Mining and Industrial Corp., on Nonoc Island, Surigao del Norte Province. The purchase price of US$333 million, US$8 million higher than the figure originally agreed to because of the inclusion of an ammonia tank farm, included a 24-megawatt, on-site powerplant, extensive lateritic ore reserves containing nickel and cobalt, and the 35,000-metric-ton-per-year capacity refinery near Surigao City. The cost of rehabilitating the refinery was estimated to be US$187.5 million. The negotiated agreement required seeking by Pacific Nickel settlement of ownership claims with Philnico's previous owner, a renowned Filipino business executive. Philnico finally ceased mining on Nonoc Island in March 1986, and the APT foreclosed on the properties because of low metal prices. The refinery previously was seized and mothballed in 1984 by the APT for unpaid debt owed to a state-owned bank.

Because of the extensive rehabilitation required following a decade of disuse, production probably would not begin for 2 to 3 years after the decision was made to proceed with renovation and development. Approximately 3,000 employees, about the same number of people employed in Philnico's operations before closure, were considered necessary to resume the operation. The Nonoc nickel mining-refining complex was the largest of all assets, including nonmining ones, to have been sold by the APT.

Coal in the Philippines generally is classified as lignite or subbituminous and is of poor quality for use in power generation. Thus, higher grade imported coal was blended with indigenous coals to improve its burning characteristics. Recently, the Philippines has imported about 900,000 t/yr of coal from Indonesia; 800,000 t/yr from Australia; and 400,000 t\yr from China. With domestic consumption of coals steadily increasing, the Government lowered in July the tariff rate to 20% on imported coals for a 3-year period. After the 3-year period, the tariff rate was to be reduced to 10% until 2004, when the final 5% rate was to take effect.

The Philippines has produced only about 2% of its crude petroleum requirements domestically, with about 95% of production coming from the West Linapacan Field in the Palawan Basin off the northwest coast of Palawan Island. Remaining domestic production was from the reopening of the Matinloc Field and the older Nido Field, both also in the Palawan Basin in the South China Sea.

The country's only gas producer was the onshore San Antonio Field on Luzon Island operated by the PNOC.

Major Sources of Information

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Major Publications

Central Bank of the Philippines, Manila: Statistical Bulletin and Annual Report.

Chamber of Mines of the Philippines, Manila: Newsletter and Annual Report.

Mines and Geosciences Bureau, Manila: Mineral News Service and Annual Report.

TABLE 1
PHILIPPINES: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1991	1992	1993	1994	1995 e/
METALS					
Arsenic: White (equivalent of arsenic acid) e/	5,000	5,000	2,000	2,000	2,000
Chromium: Chromite, gross weight:					
Metallurgical-grade	89,208	30,925 r/	7,272 r/	10,881 r/	20,000
Chemical-grade	19,756	9,988	1,600	--	--
Refractory-grade	82,520	39,596 r/	49,564	64,075 r/	75,000
Total	191,484	80,509 r/	58,436 r/	74,956 r/	95,000
Copper:					
Mine output, Cu content	148,347	123,523	136,257	112,075 r/	105,655 3/
Metal:					
Smelter	167,462	168,831	212,446 r/	200,300 r/	198,000 3/
Refined	115,471	112,460 r/	165,954 r/	154,713 r/	192,400 3/
Gold, mine output, Au content kilograms	25,916	25,609 r/	21,155 r/	27,059 r/	27,144 3/
Iron and steel:					
Ferroalloys, electric-furnace:					
Ferrochromium	23,700 r/	27,400	11,908	16,186	50,450 3/
Ferromanganese e/	5,000	5,000	5,000	5,000	5,000
Ferrosilicon e/	10,000	10,000	10,000	10,000	10,000
Steel, crude thousand tons	605	497	623	473 r/	500
Lead: Metal, secondary refined	16,100	19,100	24,300	17,200 r/	17,200
Manganese ore and concentrate, gross weight	4,064	13,798 r/	12,418	10,000 e/	10,000
Nickel, mine output, Ni content	13,658	13,000 r/	7,663 r/	9,895 r/	15,075 3/
Silver, mine output, Ag content kilograms	38,414	32,785 r/	28,043 r/	29,562 r/	26,870 3/
INDUSTRIAL MINERALS					
Barite e/	500	500	500	500	500
Cement, hydraulic thousand tons	6,913	6,667 r/	7,962	9,600 r/	9,800
Clays:					
Bentonite	42,066	7,428 r/	5,050	25,000 e/	20,000
Red	552	500 e/	791	800 e/	800
White	51,528	45,000 e/	5,557	50,000 e/	50,000
Other	808,133	742,074	700,000 e/	800,000 e/	800,000
Feldspar	47,979	48,400 r/	44,600 r/	30,000 e/	30,000
Gypsum and anhydrite, natural	28,000	25,000	25,000 e/	25,000 e/	25,000
Lime e/	7,458 3/	10,000	10,000	10,000	10,000
Magnesite e/	700	700	700	700	700
Perlite	2,894	2,800 e/	19,779	20,000 e/	20,000
Phosphate:					
Guano	11,689	326 r/	859 r/	5,000 e/	5,000
Phosphate rock	20,633	4,834	91,779	20,000 e/	20,000
Pyrite and pyrrhotite (including cuprous), gross weight	359,607	350,000 e/	316,980	320,000 e/	320,000
Salt, marine	492,859	495,816	535,481	540,000 r/ e/	540,000
Sand and gravel:					
Silica sand thousand tons	532	744 r/	828	800 e/	800
Other 4/ thousand cubic meters	15,677	15,787	15,913 r/	15,000 e/	15,000

See footnotes at end of table.

TABLE 1--Continued
PHILIPPINES: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
INDUSTRIAL MINERALS--Continued						
Stone:						
Dolomite		608,779	470,293 r/	108,150 r/	675,000 e/	675,000
Limestone 5/	thousand tons	5,384	5,092	5,190	5,000 e/	5,000
Marble (dimension), unfinished	cubic meters	24,178	263,799 r/	359,394	300,000 e/	300,000
Volcanic cinder e/	do.	2,000	2,000	2,000	2,000	2,000
Tuff		51,756	50,000 e/	3,264	50,000 e/	50,000
Quartz e/		60,000	50,000	50,000	50,000	50,000
Crushed, broken, other e/ 6/	thousand cubic meters	1,000	1,000	1,000	1,000	1,000
Sulfur: e/						
S content of pyrite		155,000	64,000	114,000	100,000	100,000
Byproduct of metallurgy		119,000	111,000	147,000	125,000	125,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades	thousand tons	1,267	1,655 r/	1,531	1,300 r/ e/	1,320 3/
Petroleum:						
Crude	thousand 42-gallon barrels	1,091	2,945	3,321	1,825 r/	1,205 3/
Refinery products:						
Liquefied petroleum gas	do.	2,777	2,914	2,607	2,806	2,800
Gasoline	do.	15,321	13,378	13,052	12,168	12,200
Jet fuel	do.	3,400 e/	4,067	3,058	4,352	4,350
Kerosene	do.	3,299	4,280	4,270	3,916	3,900
Distillate fuel oil	do.	24,157	26,733	25,213	26,338	26,300
Residual fuel oil	do.	24,131	27,474	28,431	29,582	29,600
Other	do.	5,500 e/	3,922	5,886	5,230	5,250
Refinery fuel and losses	do.	2,839	3,300	3,300	3,262	3,250
Total	do.	81,424 e/	86,068	85,817	87,654	87,650

e/ Estimated. r/ Revised.

1/ Table includes data through May 28, 1996.

2/ In addition to the commodities listed, the Philippines produces platinum-group metals as byproducts of other metals, but output is not reported quantitatively, and no basis is available to make reliable estimates.

3/ Reported figure.

4/ Includes "pebbles" and "soil" not further described.

5/ Excludes limestone for road construction.

6/ Includes materials described as rock, crushed or broken; stones, cobbles, and boulders; rock aggregates; and broken adobe.

TABLE 2
PHILIPPINES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Cement	Alsons Cement Corp., 100%	Lugait plant, Mindanao Island	624
Do.	Bacnotan Consolidated Industries Inc., 100%	Bacnotan Plant, Luzon Island	1,200
Do.	Davao Union Cement Corp., 100%	Davao City plant, Mindanao Island	648
Do.	Iligan Cement Corp., 100%	Iligan City plant, Mindanao Island	634
Do.	Northern Cement Co. Inc., 100%	Sison plant, Luzon Island	640
Do.	Republic Cement Corp., 100%	Norzagaray plant, Luzon Island	950
Do.	Rizal Cement Co. Inc., 100%	Binangonan plant, Luzon Island	964
Chromite:			
Concentrate	Acoje Mining Co. Inc., operator. (Voest Alpine AG of Austria, 75.6%; and Merlin Mining NL of Australia, 24.4%)	Santa Cruz Mine, Zambales Province, Luzon Island	100 1/
Do.	Alamag Processing Corp., operator. (Pacific Shore Mining Co., 50%; and Rio Chico Mining Corp., 50%)	Llorente, Eastern Samar Province, Samar Island	20 2/
Do.	Benguet Corp., 70%, operator; and Consolidated Mines Inc., 30%	Masinloc Chromite Operations, Zambales Province, Luzon Island	105 3/

See footnotes at end of table.

TABLE 2--Continued
PHILIPPINES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Chromite--Continued:			
Ferrochromium	Ferrochrome Philippines Inc., operator. (Voest Alpine AG of Austria, 100%)	Tagoloan plant, Misamis Oriental Province, Mindanao Island	60
Do.	Philippine Minerals and Alloy Corp., 100%	Manticao plant, Misamis Oriental Province, Mindanao Island	10
Do.	Integrated Chrome Corp., 100%	do.	28
Coal	Semirara Coal Corp. (Government), manager. Voest Alpine AG of Austria, 60%; National Development Corp., 36%; and Development Bank of the Philippines, 4%)	Unong Mine, Antique Province, Semirara Island	1,000
Copper, ore	Atlas Consolidated Mining and Development Corp., 100%	Cebu Copper Operations, Cebu Province, Cebu Island	24,250
Do.	Benguet Corp., 50%, operator; and Dizon Copper-Silver Mines Inc., 50%	Dizon Copper-Gold Operation, Zambales Province, Luzon Island	6,000
Do.	Far Southeast Resources Inc., manager. (Lepanto Consolidated Mining Co. Inc., 60%; and CRA Ltd. of Australia, 40%)	Far South East Project, Benguet Province, Luzon Island	4,000 4/
Do.	Lepanto Consolidated Mining Co. Inc., 100%	Mankayan Mine, Benguet Province, Luzon Island	1,100
Do.	Marcopper Mining Corp., operator. Provident Tree Farms, 60%, and Placer Dome Inc. of Canada, 40%	Marcopper Mine, Marinduque Province, Marinduque Island	30,000
Do.	Maricalum Mining Corp., manager. [Asset Privatization Trust (Government), 100%]	Sipalay Mine, Negros Occidental Province, Negros Island	6,250
Do.	Philex Mining Corp., 100%	Sto. Tomas II (Padcal) Mine, Benguet Province, Luzon Island	10,200
Copper, metal, refined	Philippine Associated Smelting and Refining Corp., operator. [National Development Corp. (Government), 42%; Japanese consortium of companies led by Marubeni Corp., 32%; domestic copper producers led by Atlas Consolidated Mining and Development Corp., 21%; and International Finance Corp. (United Nations Agency), 5%]	Isabel, Leyte Province, Leyte Island	172
Gold kilograms	Atlas Consolidated Mining and Development Corp., 100%	Masbate Gold Operations, Masbate Province, Masbate Island	2,500 5/
Do. do.	Benguet Corp., 100%	Benguet Gold Operations, Benguet Province, Luzon Island	1,100 5/
Do. do.	do.	Benguet Antamok Gold Operation, Benguet Province, Luzon Island	3,000
Do. do.	Philex Mining Corp., 100%	Bulawan Mine, Negros Occidental Province, Negros Island	2,800 4/
Do. do.	United Paragon Mining Corp., operator. (Paragon Resources of Australia, 12.5%; and public shares, 87.5%)	Longos Mine, Camarines Norte Province, Luzon Island	1,800
Iron ore, sinter	Philippine Sinter Corp., operator. (Kawasaki Steel Corp. of Japan, 100%)	Cagayan de Oro, Misamis Oriental Province, Mindanao Island	5,000 6/
Nickel, ore	Rio Tuba Nickel Mining Corp., 60%; and Japanese interests, 40%	Rio Tuba Mine, Palawan Province, Palawan Island	500
Do.	Taganito Mining Corp., 100%	Taganito Mine, Palawan Province, Palawan Island	100
Petroleum thousand 42-gallon barrels per day	Caltex (Philippines) Inc., 100%	Caltex Batangas Refinery, Batangas Province, Luzon Island	68
Do. do.	Petron Corp., operator. [Philippine National Oil Co. (Government), 100%	Petron Bataan Refinery, Bataan Province, Luzon Island	156
Do. thousand 42-gallon barrels per day	Pilipinas Shell Petroleum Corp., 100%	Shell Batangas Refinery, Batangas Province, Luzon Island	70
Steel	National Steel Corp., operator. [National Development Corp. (Government), 100%]	Iligan, Lanao del Norte Province, Mindanao Island	350

e/ Estimated.
1/ Metallurgical-grade concentrates.
2/ Chemical-grade concentrates.
3/ Refractory-grade concentrates.
4/ In planning stage during year.
5/ On care and maintenance during year.
6/ Self-fluxing sinter.

THE MINERAL INDUSTRY OF

SRI LANKA

By Chin S. Kuo

The major mineral commodities produced in Sri Lanka were gemstones, graphite, and titanium minerals. The country was one of the world's top 10 producers of colored gemstones, lump and chip graphite, ilmenite, and natural rutile. Phosphate mining and downstream processing of mineral sands had the best potential for future mineral development. *(See table 1.)*

The Government was seeking active foreign participation in the exploitation of mineral resources. The Geological Survey and Mines Bureau acts as a coordinating agency for mineral exploration and grants exploration licenses for up to 10 years. The Government also planned to begin a new privatization program of key state enterprises which might lead to the partial sale of Lanka Phosphate Ltd.

Sri Lanka produced more than 60,000 metric tons per year (t/yr) of ilmenite and between 4,000 and 5,000 t/yr of rutile. Consolidated Rutile and Renison Goldfields Consolidated, both of Australia, sought licenses to prospect for gold and other minerals in Sri Lanka. Consolidated Rutile was granted exploration rights for ilmenite and rutile on the northwestern and eastern coasts. Renison Goldfields Consolidated was prospecting for gold and also was interested in mineral sands.

Kahatagaha Graphite Lanka Ltd. planned to increase output from its underground mine that currently had a production capacity of 3,500 t/yr. A restructuring plan would involve the sinking of a subvertical shaft from the 345 meter (m) to the 610-m level and the construction of a beneficiation plant to increase the proportion of high-purity graphite produced.

Freeport-McMoRan Resources Partners Ltd. of the United States set up a $400-million[1] phosphate mining and fertilizer manufacturing project in Sri Lanka. State-owned Lanka Phosphate Ltd. planned to form a joint venture with the company to develop a phosphate deposit at Eppawela in the north-central Anuradhapura district as a feedstock. Proven reserves were estimated at 25 million metric tons (Mt) with a total inferred resource of 60 Mt.[2] The fertilizer unit at the northeastern port of Trincomalee would be operated by Freeport-McMoRan's Agrico subsidiary and produce 600,000 t/yr of diammonium phosphate, mainly for export. Startup was expected in early 1998.

The country was considering a proposal by a consortium of foreign oil and power companies to build a $2 billion crude oil refinery and diesel powerplant. The refinery was proposed on a site in southern Hambantota district and would process up to 6.5 Mt/yr of crude. The project was being designed conforming to the World Bank and Central Environmental Authority guidelines. An environmental impact assessment and environmental mitigation plan were under preparation.

Environmental Technologies USA Inc. reached an agreement with Maharaja Organization Ltd. to establish a plastics recycling operation in Sri Lanka in the form of a joint venture. Equity participation and attractive earnings potential were envisioned by the U.S. company. A market analysis would be conducted on the types, sizes, and availability of plastics that could be successfully recycled. The country's use of disposable plastic products continued to grow along with its population.

The Government was formulating a national energy policy in response to a looming power crunch that could seriously undermine its plan to boost exports. The growth rate in the power sector was expected to be in the region of 10% per year.

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[1] Where necessary, values have been converted from Sri Lankan rupees (SLR) to U.S. dollars at the rate of SLR50.12=US$1.00 for 1995.

[2] Mining Journal. Apr. 21, 1995, p. 292.

Major Sources of Information

Ceylon Petroleum Corp.
P.O. Box 634, 113 Galle Road
Colombo 3, Sri Lanka
Lanka Ceramic Ltd.
Colombo, Sri Lanka
Sri Lanka Government
Colombo, Sri Lanka
State Gem Corp.
Colombo, Sri Lanka
State mining and Mineral Development Corp.
Colombo, Sri Lanka

TABLE 1
SRI LANKA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
Cement, hydraulic	thousand tons	400 e/	817	676	925	900
Clays:						
Ball clay		25,000 e/	18,558	21,017	16,085	17,000
Kaolin		7,737	6,759	7,000 e/	7,500 e/	7,500
Brick and tile clay e/		75,000	75,000	7,722 3/	7,800	8,000
Clays for cement manufacture e/		320 3/	300	400	500	550
Feldspar, crude and ground		9,908	7,524	8,000 e/	12,280	12,000
Gemstones, precious and semiprecious, other than diamond e/	value, thousands	$57,000	$58,000	$60,000	$60,300	$61,000
Graphite, all grades		6,381	3,307	5,163	2,946	3,000
Iron and steel, metal, semimanufactures		47,659	53,811	39,015	55,117	50,000
Mica, scrap e/		200	200	200	200	200
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	1,168	957	1,390	1,582	1,600
Jet fuel	do.	722	553	724	488	500
Kerosene	do.	1,173	985	1,464	1,488	1,500
Distillate fuel oil	do.	3,450	2,700	3,980	4,495	4,500
Residual fuel oil	do.	3,801	4,383	3,753	3,868	3,800
Other	do.	1,030	471	240	464	500
Refinery fuel and losses	do.	464	428	461	400 e/	450
Total	do.	11,808	10,477	12,012	12,785	12,850
Phosphate rock		19,693	26,010	35,681	32,313	32,000
Rare-earth metals, monazite concentrate, gross weight e/		200	200	200	200	200
Salt		52,888	121,875	43,344	56,162	60,000
Stone:						
Limestone	thousand tons	621	600 e/	650 e/	670 e/	700
Quartz, massive		978	1,130	1,133	1,200 e/	1,100
Titanium concentrate, gross weight:						
Ilmenite		60,861	33,283	76,930	60,445	60,000
Rutile		3,085	2,741	2,643	2,410	2,400
Zirconium, zircon concentrate, gross weight		26,123	13,368	14,401	22,310	20,000

e/ Estimated.

1/ Table includes data available through Aug. 22, 1996.

2/ In addition to the commodities listed, crude construction materials such as sand and gravel and varieties of stone presumably are produced, but available information is inadequate to make reliable estimates of output levels.

3/ Reported figure.

THE MINERAL INDUSTRY OF

TAIWAN

By Pui-Kwan Tse

Taiwan's economy maintained stable growth in 1995. The gross domestic product growth for 1995 stood at 6.06%, almost a full percentage point below the original governmental target of 6.9%. The exercises sparked an outward rush of capital which, coupled with sluggish consumer spending, had slowed down the Taiwan's economic growth in 1995. However, its economic growth was a remarkable achievement by the standards of an industrialized country.

Taiwan authorities had a consistent policy to provide a favorable environment for private investment, stimulate investment potential, and attract investment from foreign "high-tech" companies. The Government was making an effort to review and revise outmoded laws and regulations, simplify administrative procedures, and set up special agencies to help enterprises to upgrade technological investments.

Its population grew from 21.1 million in 1994 to 21.3 million in 1995, and the per capita gross national product (GNP) increased from $11,604[1] in 1994 to $12,493 in 1995. The total labor force remained at 9.2 million, and the unemployment rate increased to 1.8%. The output value of the mining sector was 0.33% of GNP, which is insignificant compared with other sectors. The consumer price index rose only 3.7% in 1995 from that of 1994.

Taiwan authorities opened the financial securities sector to more foreign firms. Such market liberation would bring the local market into alignment with the policies of the General Agreement on Tariffs and Trade. The Government reportedly believed that the growing competition would improve domestic financial management and upgrade the operational technology of local securities houses.

The Government developed a set of programs to address major problems in the areas of land, environment, labor, tariff rates, and financing to improve domestic investment conditions. The Government urged the local business community to "keep their roots in Taiwan" and to stop the exodus. The plan indicated that those who make large, substantial investments would be given the opportunity to arrange for favorable financing through the issuance of corporate convertible bonds. Imports of essential raw materials and equipment would be given preferential tariffs or quota rates. Taiwan's Environment Protection Agency (EPA) would develop more flexible regulations for less-polluting industries such as electronics.

The Ministry of Economic Affairs (MOEA) developed a plan to develop Taiwan as an Asia-Pacific Regional operations center. MOEA believed that the Asian Pacific region would have the world's highest economic growth in the next two decades. The goal was to concentrate on activities in six areas: manufacturing, sea transportation, air transportation, finance, telecommunications, and training. Taiwan had signed investment guarantee agreements with Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. Negotiation for such an agreement with other southern Asian countries was proceeding.

Taiwan's EPA was established in August 1987 under the Executive Yuan to address environmental degradation that had become one of the most serious problems in Taiwan. According to Taiwan's Six-Year Development Plan, the country would invest $37 billion in pollution control and environmental protection systems. Environmental regulations would be strengthened to protect the society. In 1992, Taiwan's Legistrative Yuan passed the Air Pollution Control Act and strengthened noise pollution regulations to enforce a higher living standard in the country.

Industry production accounted for about 34% of the country's GNP. The Industrial Development Bureau (IDB) of the MOEA was the major Government agency dealing with industry affairs. IDB initiates specific industrial policies and development strategies. However, overall economic planning, coordination, and policy evaluation were handled by the Council for Economic Planning and Development.

During the past two decades, natural gas and coal reserves had slowly depleted, and the mining industry had also declined. Total mining output was less than 1% of total industrial production. The major mining activities in Taiwan were coal, dolomite, limestone, marble, natural gas, and salt. Coal, natural gas, and salt were mined in western Taiwan. Marble and limestone quarries were operated in eastern Taiwan. Employment in the mining and quarrying industry had steadily decreased since the early 1980's to 14,000 in 1995. The production of major mineral commodities is listed in table 1.

Because of a shortage of labor, Taiwan's industry shifted from labor-intensive products to technology- and capital-intensive goods. In 1995, the imports on metals and minerals accounted for more than 36.1% of the total imports. It reflected the demand for quality consumer goods and capital- and technology-intensive machines and equipment.

The demand for mineral products had continuously increased over the years, while local supplies kept dwindling. The bulk of domestic supply could meet only about 25% of the country's needs. Coal, oil, and natural gas were the country's most valuable mine products. Carbonate minerals, such as dolomite, limestone, and marble, composed the most important nonfuel mining sector. In addition to the aggregates, clays, feldspar, salt, and talc made up the remaining mine production. In the metals production sector, the country produces iron and steel and processes aluminum, copper, lead, nickel, tin, and zinc from imported raw materials. Major nonfuel and fuel producers are listed in table 2.

There were 12 cement companies with a total annual output capacity of 23 million metric tons (Mt). Taiwan's cement industry would face a shortage in 1997 when the mining rights on its east coast expire. Domestic cement production would be cut as much as 40% in 1997. Cement companies were looking for investment opportunities in other countries to construct greenfield plants and to expand the output capacity of their plants in the east to ensure the stable supply of cement for the country's needs. The island consumed about 28 Mt of cement annually, and the shortage was met by imports, mainly from Japan. MOEA approved Chia Hsin Cement Corp.'s plan to invest $120 million to build a new cement plant in the Philippines. Taiwan Cement Corp. planned to invest $230 million to set up production lines in Indonesia, Malaysia, the Philippines, and Thailand.

China Development Corp. of Taiwan signed a memorandum of understanding with Djajanti Group of Indonesia to build a $600 million joint-venture cement plant in the east of Indonesia. The plant would have an annual output capacity of 3.4 Mt.

Since the shutdown of the island's only copper smelter-refinery in 1991, Taiwan relied on imports for refined copper, mainly from Chile, the United States, and Japan. Over 200 copper-processing plants in Taiwan consumed about 583,000 metric tons (t) of copper each year. Because of rising labor costs, difficulties in land acquisition, and stiffening environmental protection regulations, domestic secondary copper recovery companies were exploring opportunities to move their less profitable scrap plants to neighboring countries.

China Steel Corp. (CSC), the only pig iron producer in Taiwan, received a total of $422 million in loans from Kreditanstalt fur Wiederaufbau of Germany ($340 million) and West Merchant Bank of the United Kingdom ($82 million) for its fourth-phase expansion project. The 8-year noncollateral loans were set at a fixed rate of 5.38% for the United Kingdom loan and less than 7% for the German loan. CSC estimated that the expansion project would require a total investment of $2.13 billion. Hitachi Zosen Corp. of Japan was awarded the contract to provide a sintering plant to CSC. The sintering plant would have a daily steel production capacity of 12,000 t and be equipped with a trough-type circular chilling machine with a built-in chamber to reduce air leakage, save energy and labor, and protect the environment.

CSC placed an order with MDS Mannesman Demag Sack of Germany to supply a hot wide strip mill with an annual capacity of 3 Mt. The order included a two-stand roughing train; a seven-stand, four-high finishing train; two coiling facilities; and inspection lines. The mill could produce carbon and special steel slabs down to a thickness of 1.2 millimeters and the width between 90 centimeters (cm) and 188 cm.

CSC signed a memorandum of understanding with Kuei Yu Industrial to jointly build a $2.1-billion steel plant in Taichung. The new plant would have an annual production capacity of 3.25 Mt of crude steel. It would become the second largest steel plant after CSC in Taiwan. Construction of plant would begin in January 1996 and was expected to be completed by the end of 2000.

Yeih Loong Group decided to invest $4.15 billion in next 5 years to build an integrated steel mill. According to the plan, the mill initially would have three blast furnaces with an annual total output capacity of 7.5 Mt of crude steel and 2.3 Mt of hot coil in Chiku, Tainan County. The three blast furnaces would be supplied by Japan's Ishikawajima-Harima Heavy Industries Ltd. The first-phase construction was expected to be completed in 1999. A new company, Lien Ting, had been established to be in charge of this project. YLG would finance $1.37 billion of the project with the remaining funds from local and foreign bank loans. The Government was waiting for the completion of an environment assessment from the company before an approval would be granted.

Kawasaki Steel Corp. of Japan signed an agreement with Fujian Teceka Tinplate Co. in Longhai Shi, Fujian Province, China, to supply an electro-tinplate line with annual output capacity of 150,000 t. Fujian Teceka Tinplate Co. was a joint venture of Ton Yi Industrial Co. of Taiwan; China National Cereals, Oils, and Foodstuffs Import and Export Corp.; and Japan's Kawasaki Steel Corp, Kawasho Corp., and Tomen Corp. The total investment was to be about $100 million. Feedstock for the line would supplied from Ton Yi's rolling mill in Taiwan.

Ton Yi Industrial Co. was majority owned by President Enterprises Corp., with minor stakes held by Kawasaki Steel Corp. and Tomen Corp. President Enterprises Corp. was one of largest processed food companies in Taiwan. President Enterprises has 10 processed food plants in China. Ton Yi operated two can-making plants in Wuxi, Jiangsu Province, and Chengdu, Sichuan Province, to supply cans for President's processed food plants.

Taiwan Nickel Refining Corp. the only nickel smelter in

Taiwan, had an annual output capacity 14,000 t of nickel. In 1994, Taiwan's iron and steel industry consumed about 25,000 metric tons per year of nickel. Taiwan imported more than 20,000 t of unwrought nickel in 1995 to meet the country's demand.

The consumption of zinc continued growing, while as galvanizing and other zinc end-users increased. Taiwan consumed about 200,000 t of zinc in the last 2 years—diecasting (48%), galvanizing (36%), brass (8%), chemical (5%), and others (3%). The island consumed more than 20 Mt of steel. A growing portion of steel products would be galvanized flat products. The consumption of zinc in the steel sector would increase to 44% within next 3 years to overtake diecasting as the biggest zinc end-user sector. China became the biggest zinc supplier to Taiwan, even though direct trade between Taiwan and China was not allowed. All materials shipped from China to Taiwan had to be transported via a third country.

Taiwan's coal production dropped to 234,965 t in 1995. This decline was attributed to Government policies designed to close unsafe operations, high production costs, and reduced domestic coal resources. Since 1985, MOEA implemented a policy to close mines that failed to meet safety and profitability standards. The number of operating mines in Taiwan has steadily decreased from 108 pits in 1985 to 41 pits at yearend 1994.

China Petroleum Corp. (CPC), a monopoly oil importer, refining and the domestic fuel business in Taiwan, planned to diversify its imported oil sources. Of the CPC's total oil imports, the Middle East accounted for about 70%, mostly from Saudi Arabia, while East Asia, Africa, and other countries made up the rest. CPC signed an agreement with British Petroleum of the United States to import up to 15,000 barrels per day (bbl/d) crude oil from Alaska. The agreement was pending for U.S. Government approval.

Over the years, CPC had built five naphtha cracking plants, of which three remained operational and served as the main supplier of upstream petrochemical raw materials. CPC had increased its refining capacity to 770,000 bbl/d with the addition of two new distillation units in its Kaohsiung and Taoyuan plants.

CPC and Koo's Group, which had interests in banking and cement, as well petrochemicals, agreed in principal with 35% shares each to build the CPC's seventh naphtha cracking plant, the island's eighth. The Lee Chang Yung Chemical Industry Corp. would control 10% of the shares, and the remaining 20% would be held jointly by 16 downstream petrochemical producers. Potential shareholders would make a final decision on the location of the complex after conducting detailed evaluations of four proposed sites—Yunlin Offshore Industrial Zone, Kuanyin of Taoyuan County, Chiku of Tainan County, and Talinpu of Kaohsiung County. Under the project, a naphtha cracking plant would be constructed as well as an oil refinery that would have a daily capacity to handle 200,000 bbl of crude oil. The complex would also have facilities for producing downstream petrochemical products. According to IDB, because of the importance of the eighth naphtha cracker to Taiwan's economic development, the project would be eligible for preferential treatment such as low-interest loans. But the high cost of land in Taiwan might force the island's eighth naphtha cracker plant to be relocated in another country.

CPC decided to move its second naphtha cracker, which was shut down in 1994, to Indonesia. CPC and some local petrochemical enterprises in Indonesia formed a joint venture to construct a petrochemical plant at Surabaya, Indonesia. The plant would be owned by Indonesia (50%), CPC (30%), and other Taiwan's petrochemical companies (20%). The investment would be about $300 million. The project was expected to receive an approval from the Indonesian Government by June 1996.

Before 1995, Indonesia was a sole source for supplying liquefied natural gas (LNG) to Taiwan. CPC, which was responsible for LNG imports, wanted to diversify its sources of supply. CPC signed an agreement with Petronas of Malaysia to supply 1.15 Mt of LNG yearly for 20 years. The LNG would come from the field in Bintulu, Sarawak. Also, with an approval from the Mainland Affairs Council, CPC had made a proposal to China National Offshore Oil Corp. for jointly exploring oil in two areas in the East China Sea.

CPC announced the discovery of an offshore natural gas deposit at about 100 kilometers west of Kaohsiung. The deposit is located 4,000 m under the sea with an estimated of 7.3 billion cubic meters of natural gas.

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[1] Where necessary, values have been converted from New Taiwan dollars (NT$) to U.S. dollars at the rate of NT$27.4=US$1.0 in 1995.

Major Sources of Information

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15 Foochow Street, Taipei, Taiwan
Taiwan Provincial Bureau of Mines
2 Chenkiang Street, Taipei, Taiwan

Major Publications

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Ministry of Economic Affairs, Department of Statistics, Taipei: Industrial Production Statistics, monthly.
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TABLE 1
TAIWAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
METALS						
Gold, primary	kilograms	--	(2/) r/	(2/) r/	5 r/	4
Iron and steel, metal:						
Pig iron	thousand tons	5,561	5,292	6,116	5,941	6,056
Ferroalloys:						
Ferromanganese		40,110	37,802	13,628	7,000 e/	5,000 e/
Ferrosilicomanganese		12,801	3,991	--	--	--
Ferrosilicon		6,252	2,606	689	500 e/	400
Steel, crude	thousand tons	10,957	10,705	12,038	11,590 r/	11,605
Nickel, refined e/		11,200	10,000	9,000	10,000	10,000
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand tons	19,389	21,464	23,971	23,722	22,478
Clays:						
Fire clay		79,497	55,008	35,094	24,354	10,194
Kaolin e/		92,970 3/	100,000	100,000	100,000	100,000
Feldspar		1,339	2,216	1,716	778	--
Gypsum, precipitated		3,723	1,673	3,182	2,876 r/	2,600 e/
Lime		613,942	669,712	650,000 e/	650,000 e/	650,000 e/
Mica		8,596	11,038	9,751	5,220 r/	5,000 e/
Nitrogen, N content of ammonia		243,389	223,719	219,781	215,377	225,750
Salt, marine		195,319	25,732	176,298	185,987	220,531
Sodium compounds, n.e.s.:						
Caustic soda		119,600	131,223	140,978	171,840	183,330
Soda ash		109,320	91,497	89,283 r/	128,327 r/	128,090
Stone:						
Dolomite	thousand tons	363	254	281	264	196
Limestone	do.	15,352	16,885	13,085	13,297	13,270
Marble	do.	11,352	14,604	17,713	17,740	16,975
Serpentine	do.	414	405	433	475	447
Sulfur		125,819	118,621	153,076	154,778	167,468
Talc		18,518	6,085	5,015	4,290 r/	4,000 e/
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		60,330	65,409	62,527	80,691	90,384
Coal, bituminous	thousand tons	403	335	328	285	245
Coke	do.	14	--	--	--	--
Gas, natural: e/						
Gross	million cubic meters	928	872	826	867	889
Marketed	do.	870	840	790	820	820
Petroleum:						
Crude	thousand 42-gallon barrels	694	452	445	431	440 e/
Refinery products:						
Gasoline	do.	37,070	40,740	44,050	47,320	48,000 e/
Kerosene e/	do.	2,350 3/	2,000	2,000	2,000	2,000
Diesel oil	do.	30,240	30,800	33,840	36,540	37,000 e/
Fuel oil	do.	83,580	81,870	84,820	88,580	89,000 e/
Lubricants fuel oil e/	do.	1,000	1,000	1,000	1,000	1,000
Asphalt. e/	do.	3,000	3,000	3,000	2,500	2,500
Liquefied petroleum gas	do.	14,220	14,880	15,010	15,380	15,400 e/
Other 4/	do.	8,740	8,120	7,990	4,000	4,500 e/
Total e/	do.	180,200	182,410	191,710	197,320	199,400

e/ Estimated. r/ Revised.

1/ Includes data available through July 10, 1996.

2/ Less than 1 unit.

3/ Reported.

4/ Includes naphtha, solvent oil, and base oil.

TABLE 2
TAIWAN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilitites	Annual capacity e/
Cement	Asia Cement Corp.	Hsinchu	1,800
Do.	do.	Hualien	11,150
Do.	Chia Hsin Cement Corp.	Kaoshiung	2,200
Do.	Lucky Cement Corp.	Tungao	1,800
Do.	Chien Tai Cement Co. Ltd.	Kaoshiung	1,758
Do.	Hsing Tai Cement Co. Ltd.	Taipei	1,300
Do.	Taiwan Cement Corp.	Chutung	1,400
Do.	do.	Hualien	280
Do.	do.	Kaoshiung	1,900
Do.	do.	Suao	2,230
Do.	Universal Cement Corp.	Kaoshiung	1,400
Coal, bituminous	Numerous independent operators	Taipei Prefecture (22 pits)	400
Marble	Taiwan Marble Co., Ltd.	Panchiao	10
Nickel	Taiwan Nickel Refinery	Kaoshiung	12
Petroleum:			
Crude thousand barrels per year	Chinese Petroleum Corp.	Chuhuangkeng and Tungtzuchiao	850
Refinery products do.	do.	Kaoshiung	150,000
Do. do.	do.	Taoyuan	33,000
Steel	China Steel Corp.	Kaoshiung	6,400
Do.	Tung Eng Iron Work Co. Ltd.	do.	90
Sulfur	China Petrochemical Development Corp.	Taipei	50

e/ Estimated.

THE MINERAL INDUSTRY OF

THAILAND

By Pui-Kwan Tse

Thailand had been one of the world's fastest-growing economies since the mid-1980s. After four consecutive years of rapid expansion averaging more than 10% per year in the late 1980's, the Thai economy appeared to return to more sustainable paths of 8% yearly in the early 1990's. In 1995, the gross domestic product (GDP) grew by an estimated 8.6% from 1994. The inflation rate rose by 5.8% from 1994. The primary forces of growth were exports, tourism, and foreign investment. Domestic demand also played a significant role in stimulating growth, with a high growth rate in construction, increased spending by individuals, and private and public sector investment. The current account, which measured trade in goods and services plus certain financial transfers, showed a deficit equivalent to 7.1% of GDP in 1995, up from 5.6% in 1994. Thailand's household savings had declined from 15% in 1989 to 7.3% in 1995. While Thailand's overall savings rate was high (34% of GDP in 1994), it was not enough to match the country's rate of investment. In an effort to raise overall savings, the Government considered tax incentives to encourage savings. The central bank imposed a cash reserve requirement rule on all commercial banks and finance companies. The Government also urged banks to limit credit to investors.

Rapid growth was associated with a continuing reorientation of the economy. The share of GDP in agriculture sector had declined from almost one-quarter in the 1970's to 11% in the 1990's, although it still accounted for 60% of the Thai work force. The share of the GDP in the mining and quarrying sector also declined in the last 2 decades. The manufacturing sector increased its share from 17% in 1970 to 30% in 1995. The share of exports in the GDP increased continuously from 32% in 1990 to 42% in 1995. At the same time, the manufacturing sector moved away from low-value-added activities to become a producer and exporter of higher value-added, technology-intensive industries such as petroleum products, transportation equipment, and integrated circuits. The strength of economic growth exerted upward pressure on wage rates, weakening Thailand's competitiveness for a labor-intensive market. Thailand has a high literacy rate, but the education level might well hinder the Government's goal on developing its technology-intensive industry as the future engine of growth.

Mining and quarrying in Thailand accounted for less 1.5% of the GDP and was a smaller share of total employment. Structural changes, as well as land-use conflicts, including for environmental issues, resulted in sharp declines in the production of certain mineral products. The Government policy for the mining sector changed from being export oriented to promoting sustainable development and serving the needs of domestic industry. The Government imposed export controls on tin ore and certain low-value-added minerals including lignite; gypsum; feldspar; and limestone, for which domestic demand increased.

In Thailand, minerals were owned by the State. All activities regarding mineral development were under the Ministry of Industry (MOI) and the Ministry of Science, Technology, and Environment supervision to ensure that benefits would be maximized for the country. The Department of Mineral Resources under the MOI was responsible for issuing licenses, establishing emission standards, monitoring compliance, and enforcing regulation for mining activities.

Production of nonmetallic mineral products, metal, and fabricated metal products accounted for about 9.4% of the total Thai manufacturing sector output. Iron and steel and petrochemicals were identified by the Government as a sectoral priority of investment promotion. New projects were permitted 8-year corporate income tax exemptions regardless of location. In 1991, the Board of Investment (BOI) decided to liberalize the iron and steel sector to meet the domestic demand. About 90% of domestic production was composed of long products, and the remainder was casting and forging products. Within the next 3 years, BOI was expecting that Thailand would have the capacity to manufacture all types and forms of iron and steel products.

Thailand had reduced its dependence on imported energy for domestic consumption from 90% in 1980's to 60% in 1990's. Domestic production of energy resources (primarily natural gas) increased by eightfold in the same time. In 1995, energy imports accounted for about 70% of domestic consumption, and domestic production was about 810,000 barrels per day. The major problems facing Thailand's energy sector were rapidly increasing energy demand, a distorted pricing structure, environmental deterioration related to vehicle emissions, and the use of lignite coal in power generation.

Because of the rapid growth and industrialization of the Thai economy, the Thai Government decided to restructure its tariff system to enable industries to operate efficiently. The Ministry of Finance announced that effective on January 1, 1995, the average tariff rate of mineral fuels and petrochemicals was reduced from the level of 30% in 1994 to 17% by 1997. A grace period for this reform was scheduled in two phases. The first phase would reduce tariffs by only one-half of the intended amount. The second stage would implement the full tariff reduction on January 1, 1997. The number of required import licenses in Thailand had also decreased significantly. A number of major products such as liquefied petroleum gas, kerosene, motorcycles, and certain buses remained subject to conditional import prohibitions.

MOI announced that the Government would suspend the gypsum mining licenses to relieve the oversupply in 1996. However, gypsum exploration was allowed to continue. Gypsum production had exceeded the domestic consumption and the surplus in the domestic market had led to severe price cutting among exporters. Under the Government policy, the export volume of gypsum would be reduced gradually in the next several years in order to protect the country's natural resources.

Thai Copper Industries Co. Ltd. was established by Thai banks and institutional investors as the major shareholder in 1995 after Padaeng Industry Co. Ltd. (PDI) withdrew its participation in the multinational joint venture involving Australia, Japan, and Switzerland in 1993. Thai Copper Industries received a $455 million syndicated loan from seven Thai banks and financial institutions to finance its 165,000 metric-ton-per-year (t/yr) copper plant in Rayong Industry Park, Rayong Province. The company also planned to offer 80 million shares at $0.4 per share in the local market. The total cost of the copper project was about $600 million. Thai Copper Industries awarded Sofresid Francois Thuault of France a $420 million turnkey contract to build the copper plant. The plant was expected to be on-stream in October 1998. Mitsui and Co. (Thailand) Ltd., Thai MC Co., and Marubeni Corp. of Japan signed an agreement with Thai Copper Industries to purchase 83% of its refined copper output. Swiss-based Interacid Trading S.A. agreed to purchase sulfuric acid produced from the smelter. Slime from the plant would be purchased by the Union Miniere S.A. of Belgium. Construction of the plant was scheduled to begin in April 1996. Union Miniere S.A. would provide technical support in construction as well as in the operation stage. Thailand consumed about 180,000 t/yr of copper, which exceeded the output capacity of the new plant. Therefore, Thailand was expected to continue copper to meet the gap between demand and domestic supply.

Tungkum Ltd., a joint venture of Niugini Mining of Papua New Guinea and Tongkah Harbour and Sintana Resources of Thailand, completed prefeasibility and environmental studies of its gold concession at Loei. A comprehensive report to support the applications for mining leases was submitted to the Thai Department of Mineral Resources. The company planned to build a 900 kilogram-per-year open cut gold mine in that area. The mine life was expected to last for 4 years. However, Tungkum Ltd. believed that there was a good potential of underground high-grade ore in that area. The construction cost was estimated at $6 million. The search for additional resources continued in that area.

Because of the domestic market facing excessive overcapacity of steel bars, the Association of Thai Steel Industries urged the Government to stop awarding new investment licenses to steel bar producers. In 1994, MOI issued 11 new mill licenses that were scheduled to begin production in 1996. The country's steel bar annual capacity would be at 4.4 metric tons. However, the projected demand was at 3.8 t in 1996.

Sahaviriya Steel Industries Co. (SSIC) sold a 76.25% of its shares in the Thai Cold Rolled Steel Sheet Co. to Japan's NKK Corp, Marubeni Corp, and other investors from Japan. SSIC did not have sufficient funds to repay the investment costs for the construction of the cold-rolled sheet mill. NKK would supply equipment and provide technical and operational assistance. The mill was expected to come on-stream in August 1997. The new mill would produce high-quality steel sheets of 600 to 1,550 millimeter (mm) wide and 0.18 to 3.0 mm thick for Japan's automotive and electric appliance producers operating in Thailand. SSIC had applied to BOI for approval for increasing its cold-rolled sheet output capacity from 670,000 t/yr to 1 million-metric-ton-per-year (Mt/yr).

Thailand was one of the major exporters of tin concentrate in the world, but it became a net importer of tin concentrates lately. In 1994, the country produced less than 4,000 t of tin from its tin mines. Because of depleted tin resources, the total tin output from domestic tin mines fell to about 3,000 t in 1995. Reduction of supplies of tin concentrates from domestic tin mines forced Thailand Smelting and Refining Co. Ltd., the country's only operating tin smelter, to increase tin concentrate imports from Laos and Australia. Thailand consumed about 5,000 t of tin metal each year. Surplus tin metal was exported to Japan and other Asian countries.

PDI, the only zinc metal producer in Thailand, underwent a major transformation in order to be more competitive. PDI decided to focus on zinc exploration and production as its core business. The company planned to explore new zinc resources in Thailand and abroad. PDI signed a memorandum of understanding with Western Metals Ltd. of Australia to buy 31 million shares from Western Metals. PDI would initially invest approximately $9.75 million to acquire a 10% equity stake at $0.62 per share from Western Metals. Another 10% would be acquired within 12 months. The agreement would require approval from Australia's Foreign Investment Review Board and the Thai regulatory authorities. Western Metals would use the investment from PDI to develop its Blendevale zinc deposit in Western Australia.

PDI's zinc refinery expansion project was expected to be completed according to schedule. After completion in the early 1997, the refinery would increase its annual output capacity from 70,000 t to 105,000 t. The demand for zinc concentrates would rise from the present 140,000 t to 210,000 t at that time. PDI's zinc mines were gradually depleted in the past several years and PDI required to import a large percentage of its raw material from Australia. Because of an expansion in the galvanizing sector, the consumption of refined zinc was expected to increase by 8% annually in the next several years. In 1995, Thailand consumed about 110,000 t of refined zinc. The balance was to be met by imports.

ASEAN (Association of South East Asian Nations) Potash Mining Co., a company established by a joint venture of Southeast Asian countries, awarded a $15 million contract to Trafalgar House Construction Mining of the United Kingdom to take over and restart construction of a decline access into the Bamnet Narong potash mine in the Bamnet Narong District of Chaiyaphum. Construction work was stopped in 1993 when the original contractor hit a brine aquifer that caused flooding in the area. Trafalgar House Construction Mining demonstrated that the company could safely penetrate the aquifer on an incline shaft to the depth of 180 meter (m). The 180-m-deep shaft would connect between the potash processing plant on the surface and the underground deposits. Construction work was scheduled to begin in March 1996 and was expected to be completed in 18 months. During construction, 280,000 t of rocksalt would be produced. It was expected to start production of 1.1 million metric tons (Mt) of potash, 250,000 t to 300,000 t of sodium chloride, and 4.1 million cubic meter of 450 gram-per-liter magnesium chloride solutions yearly by the year 2000 for the next 100 years. ASEAN selected this mine to supply potash to its members and other Asian countries. ASEAN consumed about 1.6 Mt/yr of potash and was expected to reach 2 Mt in the year 2000.

Asia Pacific Potash Corp, a joint venture of Asia Pacific Resources of Canada (62.5%), Thai Central Chemical Corp. (27.5%), and the Thai Government (10%), completed its potash exploration project at Udon Thani, Thailand. Potash reserves in the Korat Plateau were about 160 Mt with an average grade of 25.5% of potassium oxide. The drilling conducted in the Somboom area, a 2% of Asia Pacific's total concession area of 2,333 square kilometers, identified that an average thickness of the potash deposit was 4.1 m at the depth less than 300 m. The potash deposit in the Somboom area was estimated to supply 2 Mt/yr of potash for 20 years. With a final feasibility study due to be completed by the end of 1996, the startup of mine was scheduled for 1999.

In October 1995, MOI announced the invitation to bid for exploration and production of petroleum in an area of 120,000 km^2 in Andaman Sea. The proposals were to be submitted in January 1996.

The Petroleum Authority of Thailand (PTT) implemented a program to restructure the agency into five sectors—exploration, gas, oil, petrochemical, and production and refinery. PTT allowed a float of 25% shares in each sector to be listed in the stock market as a step toward privatization. The remaining 75% in each sector remained under the control of PTT. The restructuring and privatization moves reflected the continuous growth in demand for energy because of the country's strong economic growth. It also reflected the agency's increasing demand for capital to compete with other multinational oil companies in Thailand. The PTT also expanded its business activities in Asian countries. It had established retail gasoline and liquid petroleum gas markets in Burma, China, Cambodia, Laos, the Philippines, and Vietnam.

In 1995, PTT signed a 30-year concession agreement with Thaipo Ltd., a subsidiary of Pogo Producing Co. of the United States, to supply natural gas from the Tantawan Field in the Gulf of Thailand. The agreed price was $1.90 per million British thermal units. The Tantawan Field had proven reserves of 8.5 billion cubic meters of natural gas and was 56 kilometers from the PTT's transmission pipeline.

Thailand's petrochemical sector continued to expand to meet the country's demand. New integrated complexes were being built by Thai Petrochemical Industries and by Siam Cement Co. Ltd. (SCC). TPI's 350,000 t/yr cracker plant was scheduled to begin operation in 1998 and the company planned to build a second unit after that. SCC's naphtha-based 600,000 t/yr cracker plant was expected to come on-stream in 1999. Under the Government's tariff protection and controlled investment policies, the petrochemical sector became sufficiently mature to sustain international competition. Therefore, BOI announced that the Government would liberalize the country's production capacities of olefin in 1997 and aromatics in 2003.

Major Sources of Information

Department of Mineral Resources
  Ministry of Industry
  Thanon Rama 6, Bangkok 10400, Thailand
National Statistical Office
  Office of the Prime Minister
  Larn Luang Road, Bangkok 10100, Thailand
Mining Industry Council of Thailand
  132 Sinthorn Building, Room 11, Wireless Road
  Bangkok 10500, Thailand
The Electricity Generating Authority of Thailand
  52 Charan Sanit Wong Road
  Bang Kruai, Nonthaburi 11000, Thailand

Major Publications

Department of Mineral Resources, Bangkok:
  Mineral Statistics of Thailand (annual).
National Statistical Office, Office of the Prime Minister, Bangkok:
  Statistical Summary of Thailand, 1987 et seq.
  Statistical Yearbook of Thailand, 1990 et seq.
Bank of Thailand, Bangkok:
  Annual Economic Report.

TABLE 1
THAILAND: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995p/
METALS						
Antimony:						
Ore and concentrate:						
Gross weight		141	632	1,464	1,123 r/	522
Sb content e/		60	269	620	500	230
Metal, smelter		2,256	1,847	1,692	1,424 r/	577
Cadmium		--	635	449	643	600 e/
Columbium and tantalum ores and concentrates: 2/						
Gross weight	kilograms	3,000	--	--	--	--
Cb content	do.	510 e/	--	--	--	--
Ta content	do.	810 e/	--	--	--	--
Iron and steel:						
Iron ore:						
Gross weight		240,075	427,242	208,939	142,795 r/	34,480
Fe content		132,040	234,980	115,000	78,000 r/	17,000
Metal: Steel:						
Crude	thousand tons	711	779	954	1,460 r/	1,500 e/
Ferroalloys:						
Ferromanganese		1,546	549	70	140	150 e/
Silicomanganese		3,938	4,275	1,503	689	650 e/
Lead:						
Mine output, Pb content of 42.5% Pb concentrate		16,680	11,880	6,050	7,950	9,680
Metal: Ingot, secondary		12,843	18,906	17,060	16,904 r/	19,070
Manganese ore:						
Battery- and chemical-grade, 75% MnO2		2,539	1,676	1,925 r/	1,152 r/	815
Metallurgical-grade, 46% to 50% MnO2		8,493	6,151	4,530 r/	5,300 r/	2,663
Total, gross weight		11,032	7,827	6,455	6,452 r/	3,478
Total Mn content e/		5,300	3,800	3,100	3,100	1,600
Rare-earth minerals:						
Monazite concentrate, gross weight		400	89	220	57 r/	--
Xenotime		15	--	--	--	--
Tin:						
Mine output, Sn content		14,937	11,484	6,363	3,926 r/	2,201
Metal, smelter, primary		11,255	10,679	8,099	7,759 r/	8,243
Titanium:						
Ilmenite concentrate, gross weight		17,071	2,922	20,715	1,600 r/	--
Leucoxene concentrate, gross weight		4	45	106	77 r/	33
Rutile concentrate, gross weight		76	281	87	49 r/	--
Tungsten concentrate:						
Mine output, gross weight		440	178 r/	203 r/	93 r/	92
Mine output, W content		230	70	80 r/ e/	40 r/ e/	60
Zinc:						
Mine output, gross weight		496,006	407,180	445,761	349,642 r/	135,198
Mine output, Zn content		87,000	62,000 e/	70,000 e/	55,000 e/	20,000
Metal, smelter, primary		62,152	60,557	65,000 e/	58,513 r/	46,398
Zirconium concentrate, gross weight		2,573	1,723	707	326 r/	--
INDUSTRIAL MINERALS						
Barite		92,974	46,328	42,385	53,248 r/	58,807
Cement, hydraulic	thousand tons	18,054	21,832	26,870	26,000 e/	26,500 e/
Clays:						
Ball clay		178,192	224,254	345,846	329,286 r/	308,001
Kaolin, marketable:						
Beneficiated		255,543	301,035	397,330	417,064 r/	460,629
Nonbeneficiated		125,563	182,255	209,994	108,442 r/	--
Filler		733	3,445	6,699	8,503 r/	10,856

See footnotes at end of table

TABLE 1--Continued
THAILAND: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 p/
INDUSTRIAL MINERALS--Continued						
Diatomite		7,328	10,425	8,290	5,874 r/	5,991
Feldspar		702,603	559,806	600,835	554,227 r/	670,178
Fluorspar, crude mine output						
Metallurgical-grade		60,617 r/	51,597 r/	48,387 r/	23,705 r/	24,114
Low-grade		--	--	600	--	--
Total		60,617 r/	51,597 r/	48,987 r/	23,705 r/	24,114
Gemstones	thousand carats	4,352	4,766	3,032 r/	2,105 r/	1,036
Gypsum	thousand tons	7,196	7,111	7,456	8,140 r/	8,533
Phosphate rock, crude		5,936	7,981	10,764	7,739 r/	9,301
Salt:						
Rock		124,500	212,750	261,612	287,806 r/	380,544
Other e/		100,000	100,000	100,000	100,000	100,000
Sand, silica		657,464	595,325	459,062	471,386	325,492
Stone:						
Calcite		18,000	17,215	7,037	23,300 r/	37,700
Dolomite		481,866	331,819	537,119	744,847 r/	668,795
Limestone for cement manufacture only	thousand tons	19,517	25,272	32,036	42,224 r/	45,559
Marble		74,984	86,995	88,398	87,163 r/	96,992
Marl for cement manufacture only	thousand tons	718	675	564	562 r/	611
Quartz, not further described		20,312	18,051	18,193	9,770 r/	11,288
Shale for cement manufacture only	thousand tons	2,448	2,860	3,597	3,574 r/	4,357
Talc and related materials:						
Pyrophyllite		42,960	34,638	43,404	55,326 r/	76,189
Talc		5,575	4,786	7,007	8,950 r/	4,252
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite		14,300	22,000	15,500	11,900 r/	5,000
Lignite	thousand tons	14,689	15,618	15,593	17,100 r/	18,419
Natural gas (gross production)	million cubic meters	8,079	8,643	9,675	10,723 r/	11,389
Petroleum:						
Crude	thousand 42-gallon barrels	8,938	9,632	9,120	9,161 r/	8,159
Natural gas condensate	do.	7,938	9,676	10,505	11,174 r/	10,936
Refinery products: e/						
Liquefied petroleum gas	do.	2,350	2,400	2,400	2,400	2,400
Gasoline	do.	18,200	19,000	19,000	19,000	19,000
Jet fuel	do.	12,000	12,500	12,500	12,500	12,500
Kerosene	do.	900	900	900	900	900
Distillate fuel oil	do.	28,400	28,500	28,500	28,500	28,500
Residual fuel oil	do.	22,300	22,500	22,500	22,500	22,500
Unspecified 3/	do.	3,400	3,400	3,400	3,400	3,400
Total	do.	87,550	89,200	89,200	89,200	89,200

e/ Estimated. p/ Preliminary. r/ Revised.

1/ Includes data available through May 7, 1996.

2/ Excludes columbium- and tantalum-bearing tin slags.

3/ Includes refinery fuel plus refinery gains or losses.

TABLE 2
THAILAND: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity e/
Antimony, concentrate	Associated Minerals Co. Ltd.	Bo Thang, 130 kilometers southeast of Bangkok (temporarily inactive)	6
Do.	Parasit Mining Co.	Doi Ngoem, 100 kilometers southeast of Chiang Mai	2
Barite	American Thai Barite Co. Ltd.	Siam Mine, 200 kilometers southeast of Phuket	25
Do.	P&S Mining Co. Ltd.	Loei Mine, 10 kilometers northwest of Loei	70
Do.	STA Mining Co. Ltd.	STA Mine, 105 kilometers southeast of Chiang Mai	100
Cement	Siam Cement Co. Ltd.	Kaeng Khoi, 90 kilometers north of Bangkok	3,300
Do.	do.	Tambol Tabkwang, Kaeng Khoi District 90 kilometers northeast of Bangkok	2,800
Do.	do.	Tha Luang, 90 kilometers northeast of Phuket	3,200
Do.	do.	Thung Song, 130 kilometers east of Phuket	900
Fluorspar, concentrate	Phanom Thuan Mining Co. Ltd.	Phanom Thuan, 45 kilometers north of Kanchanaburi	60
Do.	Skt Minerals Co. Ltd.	Mine is 47 kilometers southeast of Krabi	65
Do.	Thai Fluorite Processing Co. Ltd.	Ban Lad, Phet Buri	120
Do.	United Fluorite Co. Ltd.	Salak Pra, 80 kilometers northwest of Kanchanaburi	26
Do.	Universal Mining Co. Ltd.	Mae la Luang, 120 kilometers west of Chiang Mai	35
Lead, concentrate	Kanchanaburi Exploration and Mining Co. Ltd.	Song Toh, 250 kilometers northwest of Bangkok	45
Steel, rolled	Bangkok Iron & Steel Co. Ltd.	Bangkok	160
Do.	Bangkok Steel Industry Co. Ltd.	Samut Prakan Province, south of Bangkok	210
Do.	Sahaviriya Steel Industries Co.	Bang Saphan District, Prachuap Khiri Khan Province	2,400
Do.	Siam Iron & Steel Co. Ltd.	Saraburi Province, 100 kilometers north of Bangkok	220
Tantalum and niobium in tin slag	Thai Tantalum Co. Ltd.	Rayong	500
Tin:			
Concentrate	Numerous small companies	Offshore Andaman Sea from southern tip of Burma to south of Phuket	NA
Do.	do.	Mostly south Thailand and along southern Burma border	NA
Refined	Thailand Smelting and Refining Co. Ltd.	Phuket	38
Tungsten, concentrate	Parasit Mining Co.	Doi Ngeom, 100 kilometers southeast of Chiang Mai	0.1
Do.	Siamerican Mining Enterprise Co. Ltd.	Khao Soon, 185 kilometers east of Phuket (temporarily inactive)	1.2
Do.	Sirithai Scheelite Thailand Co. Ltd.	Doi Mok, 120 kilometers northeast of Chiang Mai (temporarily inactive)	0.4
Zinc:			
Ore	Padaeng Industry Co. Ltd.	Mae Sot, 64 kilometers west of Tak	350
Refined	do.	Tak	72

e/ Estimated. NA Not available.

THE MINERAL INDUSTRY OF

VIETNAM

By Chin S. Kuo

For Vietnam, 1995 was a banner year as the country's diplomatic and economic rehabilitation gathered pace. Yet, because of its dramatic rate of economic growth, a gross domestic product (GDP) of 9% was expected for 1995. Industrial contribution to GDP also increased substantially to about 20%. Current account deficit at 8% of GDP was the result of import boom. Inflation ran at 12.7% in 1995. The Government made more efforts to attract foreign capital, while pressing ahead with the economic reform program. Foreign investment rose to $8.7 billion[1] in 1995.

The mining sector was still relatively small and undeveloped, but the country has a wide variety of exploitable mineral reserves. Continuous geological exploration has discovered many mineral deposits including apatite, bauxite, coal, construction materials, natural gas, oil, and rare earths. Most important are the vast reserves of anthracite currently estimated at 3,000 million metric tons (Mt). Smaller reserves include antimony, chromite, copper, gold, iron ore, lead, tin, titanium, and zinc. Currently, most active minings were coal, construction materials/cement, and oil and gas. *(See table 1.)*

Foreign investment in exploration had focused on placer and primary lode gold deposits in both north and south Vietnam. Offers of significant loans from international donors, most notably Japan, the World Bank, and the Asian Development Bank, helped the country invest in badly needed infrastructure. Considerable direct foreign and local investment was made in the cement, fertilizer, construction, and mining industries.

The introduction of a new mineral policy would replace the 1989 Ordinance on Mineral Resources. The draft mineral law would give increased incentives for investment covering exclusive rights, fixed-term exploration, environmental matters, tax benefits, and exemptions under certain conditions. A new mining law to regulate Vietnam's mineral industry was expected to be enacted by March 1996. The legislation set a framework within which overseas mining companies investing in Vietnam would be guaranteed the right to exploit the resources they found.

New rules had been developed to attract more foreign capital for mining projects. The Government planned to allow foreign companies to own an increased stake in mineral properties, including the possibility of 100% ownership. Under the new investment outlines, a Vietnamese firm that had completed a project's exploration and development could form a joint venture with foreign companies to complete the mining phase. However, if neither the initial exploration and development nor the mining had begun, a foreign company could own a 100% interest in the project.

Vietnam's movement toward a free market, capitalist economy had resulted in an increase in trade with nations in the world, including the United States. The first shipment of Vietnamese low-sulfur anthracite coal was received in January at Burnside, Louisiana. On regional trade, Vietnam was to reduce its tariffs on selected products to 5% by 2003.

The Government geologists discovered seven antimony deposits with estimated reserves of 30,000 metric tons (t)[2] at Duong Huy-Cam Pha in Quang Ninh Province.

Mitsubishi Corp. of Japan and Gencor Ltd. of South Africa joined Krupp Fordertechnik of Germany and Lonrho Pacific of the United Kingdom to carry out the feasibility study on the Thach Khe iron ore project, 8 kilometers (km) northeast of Ha Tinh City and 300 km south of Hanoi. The estimated reserves of the iron ore deposit was about 520 Mt,[3] and total capital investment could reach $700 million to $1 billion. Ore grade was estimated at about 58% to 59% iron content. Production capacity of 10 million metric tons per year (Mt/yr) was foreseen in a pre-feasibility study, and open pit mining was planned. Iron ore would be exported to China and other Asian nations. Meanwhile, Austroplant of Austria and Vietnam Steel Corp. completed a feasibility study for a $1.28 billion steel plant that would produce 1.4 Mt/yr of steel. Initially, iron ore would be imported, and, later, the Thach Khe iron ore mine would supply the feedstock.

Vietnam Steel Corp., NKK, and Mitsubishi of Japan planned to develop a $80-million, 500,000-metric-ton-per-year (t/yr) steel billet project at Cai Lan in northern Vietnam. Production was to start in 1999 with an initial rate of 300,000 t/yr of billets. Because of a shortage of local scrap, a lack of port facilities, and the funding of the port, the project had been on hold. A fourth investor to join the project was being sought.

Vietnam Steel and Pohang Iron and Steel Co. Ltd. of the Republic of Korea opened a $56-million, 200,000-t/yr plant in Haiphong producing reinforcing bar and wire rod from imported billets. And the Vina Kyoei Steel joint venture had been involved in a feasibility study to build a 400,000-

t/yr plant, possibly near Da Nang.

Vietnam Steel and Daewoo Corp. of the Republic of Korea planned to form a joint venture to build a 1 Mt/yr steel works at Vung Tau or Da Nang. Total investment was estimated at $640 to $740 million. Construction was to begin by the end of 1996 with commissioning by the year 2000. Early in 1995, Daewoo linked up with Pusan Steel Pipe and a Vietnamese company called Waseco to build a 70,000-t/yr electric resistance welded pipe mill near Ho Chi Minh City.

Vietnam Steel, Nissho Iwai of Japan, and SMPC Metal Industries of Malaysia formed a joint venture, Vinanic Steel Processing, to construct and manage a 2,000-t/yr, cold-rolled sheet processing plant at Haiphong. Commission of the plant was scheduled for fall 1996. Vinanic would be owned 50% by Vietnam Steel, 30% by Nissho Iwai, and the balance by SMPC.

Three Vietnamese companies, Southern Steel, An Phu Production Services Co., and Thep Viet, formed a joint venture with Ho Asian of Taiwan to build a steel mill at Can Tho, 100 km southwest of Ho Chi Minh City. With an investment of $12.1 million, the venture planned to produce 120,000 t/yr of rebar and wire rod. Four joint-venture long product plants were licensed to come on-stream in 1995, with a potential additional 740,000 t/yr of steel rod and bar.

BHP Steel Building Products of Australia planned to build a second plant in Ha Tay Province to supply roofing and cladding sheets. The plant was to cost $7 million and should be operational in May 1996. The plant with a production capacity of 6,000 t/yr would receive raw materials supplied from BHP's plants in Australia.

Leader Resources of Australia focused on a base metals exploration project in Bac Thai Province. The exploration license covers an area of 105 square kilometers (km^2) that hosts three known mineralized targets, including the Na Tum Hill zinc/lead/silver deposit. A resource of up to 12 Mt[4] grading 15% combined zinc and lead was being tested. A lack of foreign capital had slowed the exploitation of reserves containing zinc metal. Meanwhile, Padaeng Industries of Thailand applied for a license to mine and process at a property adjacent to Na Tum Hill. A joint venture between Leader Resources and Teck Exploration of Canada applied for two gold exploration licenses for the 164-km^2 Kim Hoa prospect and the 190-km Khau Au prospect in central and northern Vietnam, respectively.

Vietnam Rare and Precious Minerals Corp., Hindustan Zinc Ltd. of India, and Bureau de Recherches Geologiques et Minieres of France were to set up a joint venture to explore and develop gold deposits at Pac Lang. India also would help in the construction of an aluminum smelter in Vietnam to utilize the bauxite reserves in the two countries, and the Geological Survey of India would help in different phases of exploration, mining, and processing of the mineral resources in Vietnam.

A group of 10 Malaysian tin companies began talks with Vietnam Rare and Precious Minerals Corp. on the possibility of mining tin in cental Vietnam. Talks were suspended pending the introduction of revised Vietnamese mining laws.

A shortage of cement in the country caused prices to double and created a chaotic black market. Demand for cement was expected to reach 9.0 Mt in 1995, but the existing cement plants could produce 7.5 Mt/yr despite an estimated increase of 2 Mt/yr. Imports of cement were expected to rise.

Five cement plants financed by foreign companies were either planned or under construction. A joint venture between Vietnam Cement General Corp. and Nihon Cement-Mitsubishi of Japan was established to build the Nghi Son cement plant at Tinh Gia, Thanh Hoa Province, at a cost of $347 million. Production capacity was planned for 2.3 Mt/yr. The plant was scheduled to come on-stream in 1996. Lucky Cement Group of Taiwan formed a joint venture with Hai Hung Province and Vietnam Commerce and Industry Bank to construct the $265 million Phuc Son cement plant with a production capacity of 1.8 Mt/yr. Chichibu-Onoda Cement and Zip Commercial Corp., both of Japan, signed a contract with Ha Tay Construction Service to build a cement plant at My Duc, Ha Tay Province. The plant was to have a capacity of 1.2 Mt/yr. Vietnam Union of Cement Plants planned to expand its Hoang Thach plant with a 3,300-metric-ton-per-day (t/d) production line that was scheduled on line in late 1995. Financing for a new 4,000-t/d cement plant at Butson was finalized in early 1995, and the plant was expected to be on-stream by the end of 1997. Technip-CLE of France was the principal contractor for the plant, and the project was underwritten by loans from two French banks. Marubeni of Japan would provide credits to cover interest payments and fees during construction. Vietnam planned an investment of $195 million in the plant.

The Government signed an agreement with five foreign companies to conduct a feasibility study to build a fertilizer complex and integrated powerplant at Phu My, southern Vietnam. They were BHP of Australia, British Petroleum, Statoil of Norway, Tomen Corp. of Japan, and Tractebel of Belgium. The $800 million project was to construct a 350,000-t/yr ammonia plant, a 600,000-t/yr urea plant, and a 600-megawatt (MW) powerplant. The complex would be linked with the offshore Nam Con Son Gasfield by a 370-km natural gas and oil pipeline. In another development, Nissho Iwai and Central Glass Co:, both of Japan, established a $35-million joint venture with a Vietnamese partner to produce 240,000 t/yr of fertilizer at Long Tranh, Dong Nai Province. The plant was due to come on-stream in 1998. The country imported 2 Mt of fertilizer in 1995, of which urea accounted for 1.3 Mt.

State-owned Fertilizer and Basic Chemicals Corp. (Ferchemco) was to form a joint venture with All Ocean

International of the United States to build a 150,000-t/yr diammonium phosphate (DAP) plant in Quang Minh Province. The $100-million project would be funded at 40% by the former and 60% by the latter and would come on-stream in 1997-98. Phosphate rock would come from local deposits. Plans for a second 250,000-t/yr DAP plant were being considered. Ferchemco also was conducting preliminary studies to build a new 560,000-t/yr ammonium-urea plant near Ho Chi Minh City.

Westralian Sands Ltd. of Australia was to restart ilmenite production, limited to 60% of capacity, or 40,000 t/yr, at its Austinh joint venture with Ha Tinh Provincial government. However, the mine expansion plans to invest $4.5 million funded by the Australia and New Zealand Banking Group in upgrading facilities to increase production capacity to 80,000 t/yr in 1995 and 100,000 t/yr by 1997 had to be postponed. Currently, an ilmenite export limit of 50,000 t/yr from this mine had been imposed. Westralian Sands has a 60% interest in the $3.2-million joint venture; the Provincial government, 30%; and the Ministry of Heavy Industry, 10%. Meanwhile, Malaysia Mining Corp. (60%), in partnership with state-run Binh Dinh Mineral Co. (40%), invested $1.79 million to develop the Catkhanh Mine in Quinhon in October for ilmenite production. The mine was believed to have reserves of zircon, monazite, and titanium ore. When fully developed, the mine was expected to produce 40,000 to 60,000 t/yr of ilmenite for export to neighboring countries.

The Government planned to increase coal production to 10 Mt/yr to supply export markets. Vietnam Coal Corp. (Vinacoal) alone produced 8.4 Mt of coal in 1995 from the Quang Ninh coal base. Vinacoal intended to increase coal production for powerplants, but was facing a severe capital shortage. Coal exports from Vietnam, mainly anthracite, had increased by an average of 35% per year for the last 5 years and accounted for 35% to 40% of production. In 1995, Vietnam exported 2.7 Mt of coal. Coal & Allied of Australia was among the companies that were interested in importing coal to Australia.

Australian Coal Industry Research Laboratories Ltd. won an international tender to construct a coal quality laboratory for Campha Coal Co. The Australian research organization had been involved in a number of projects associated with the export of anthracite and in resource development.

BHP of Australia planned to invest $766 million to develop massive gas supply, power generation, and fertilizer plant in Vietnam. A new pipeline would link several gasfields such as Lan Tay and Lan Do in block 6 to the mainland. The block 6 was reported to contain gas reserves of up to 141.5 billion m^3.[5] The gasfield development plan and pipeline project would fit with the production development of the nearby Dai Hung Oilfield. The natural gas was to be used as a feedstock for a proposed powerplant and fertilizer plant producing urea.

The Dai Hung Field operated by BHP produced lower than expected crude oil in 1995, but the country's output was still planned for 7.7 Mt at 155,000 barrels per day (bbl/d). The field produced 25,000 to 30,000 bbl/d in 1994 and only 15,000 bbl/d in October. Most of the oil would come from the Bach Ho Field and the Rong Field off the coast of southern Vietnam, operated by the VietSovPetro joint venture with Russia.

Mitsubishi Oil Co. of Japan discovered oil in the Phuong Dong Field off the southern coast of Vietnam, near the Rang Dong Field, which was found in 1994. Mitsubishi Oil's joint-venture company with Vietnam National Petroleum Corp. had been exploring for oil in the block. The two partners would assess these two oil finds for possible commercial production.

PetroVietnam, the state-owned oil company, began talks with a group of investors to build the country's first oil refinery in Quang Ngai Province. The $1.2 billion project involved PetroVietnam (30%), a group led by PETRONAS of Malaysia (30%), and a group led by LG Group of the Republic of Korea (30%). PetroVietnam and Edcon Inc. of the United States began surveying about 200,000 line km of aeromagnetic data offshore southern Vietnam over a 450,000 km^2 area. Atlantic Reconnaissance of the United Kingdom was to collect the data. The survey was the largest single geophysical project conducted offshore Vietnam to date.

A group led by ABB, the European power company, and Marubeni Corp. of Japan won a contract worth $100 million from state-owned Electricity of Vietnam to build the 287-MW Phu My 2 powerplant, southeast of Ho Chi Minh City. Construction of the plant was to begin in February 1996, and completion was scheduled for March 1997.

Major Sources of Information

Geological Survey of Vietnam
  Hanoi, Vietnam
Ministry of Energy
  Hanoi, Vietnam
Ministry of Power and Coal
  Hanoi, Vietnam

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[1] Where necessary, values have been converted from Vietnamese dong (D) to U.S. dollars at the rate of D11,000=US$1.00 for 1995.

[2] Mining Journal, Sept. 8, 1995, p. 172.

[3] The Tex Report, Nov. 13, 1995, p. 3.

[4] Mining Magazine, Apr. 1995, p. 262.

[5] State Dept. Telegram, Apr. 10, 1995, p. 1.

TABLE 1
VIETNAM: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
Bauxite, gross weight		6,000	6,000	6,000	6,500	6,500
Cement, hydraulic	thousand tons	3,000	5,000	6,500	7,200	7,500
Clays, kaolin		800	800	800	1,000	1,000
Coal, anthracite 3/	thousand tons	5,000	5,470	6,000	6,100	7,200
Gold	kilograms	1,300	10,000	10,000	10,000	10,000
Gypsum		30,000	30,000	30,000	30,000	30,000
Nitrogen, N content of ammonia		30,000	45,200	51,700 3/	53,000	52,000
Petroleum, crude 3/	thousand 42-gallon barrels	29,200	40,515	44,895	51,100	55,000
Phosphate rock:						
Gross weight 3/	thousand tons	275	290	362	470	480
P_2O_5 content	do.	88	93	116	144 3/	147
Salt	do.	350	350	350	375	375
Steel, crude 3/	do.	183	219	270	300	320
Tin:						
Mine output, Sn content		800	3,400	3,500	4,000	4,500
Metal, smelter		1,700	2,400	2,500	2,500	2,800
Zinc:						
Mine output, Zn content		15,000	15,000	15,000	15,000	15,000
Metal, smelter, primary		10,000	10,000	10,000	10,000	10,000

e/ Estimated.

1/ Table includes data available through May 20, 1996.

2/ In addition to the information listed, iron ore was mined in the past and pig iron was produced at industrial facilities, but the status of these industries under prevailing conditions was not sufficiently clear to allow formulation of reliable estimates of output levels. Similarly, data on output of crude construction materials are not available, and no basis is available to make reliable estimates of output level.

3/ Reported figure.

For Reference

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